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REPORT

OF THE

Horticultural Experiment Station

VINELAND STATION
ONTARIO
1916 and 1917

(PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE)

PRINTED BY ORDER OF
THE LEGISLATIVE ASSEMBLY OF ONTARIO

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To His Honour SIR JOHN STRATHEARN HENDRIE, C.V.O., a Lieutenant-Colonel in the Militia of Canada, etc., etc., etc.,

Lieutenant-Governor of the Province of Ontario.

MAY IT PLEASE YOUR HONOUR:

The undersigned begs to present for the consideration of Your Honour the Report of the Horticultural Experiment Station at Vineland Station for 1916 and 1917.

Respectfully submitted,

W. H. HEARST,

Minister of Agriculture.

TORONTO, 1918.

View from Administration Building of the driveway into the Experiment Station.

REPORT

OF THE

Horticultural Experiment Station

1916 and 1917.

In the early days of the Station the office and administrative work was necessarily much less than at present, and the Director in charge at that time was therefore able to personally oversee and direct the ordinary cultural operations of the Station. During succeeding years, however, the Director's time and energy were more and more required for office routine and the carrying out and recording of the experimental and investigational work under way. The various branches of this work have in turn grown and new work been added until now the Director's time is very largely taken up with the general administration of the Station. The plant breeding and the experimental work, etc., were divided and a trained assistant placed in charge of each branch. The plant breeding has in turn grown to such an extent that a further division of this department has been found necessary. There are then at the present time the following divisions of the Station work: Plant Breeding, Tender fruits; Plant Breeding, Hardy fruits; Pomology; Olericulture; and By-products.

Resignation and Appointment.

F. M. Clement, appointed Director of the Experiment Station in the spring of 1914, resigned in August, 1916, to accept the position of Professor of Horticulture in the University of British Columbia. E. F. Palmer, formerly Assistant Director of the Fruit Branch, Ontario Department of Agriculture, was appointed in September, 1916, to succeed Mr. Clement.

Publications.

Two bulletins prepared by members of the Experiment Station Staff were published by the Ontario Department of Agriculture during 1916: "The Grape in Ontario," by F. M. Clement, Director, and "Peach Growing in Ontario," by F. M. Clement and A. G. Harris, Assistant in Pomology. In 1917, two more bulletins were published: "The Pear in Ontario," by F. M. Clement and O. J. Robb, Assistant; and "Pruning," by F. M. Clement and F. S. Reeves, Hybridist.

Shorter articles on various phases of the work under way have been written from time to time by members of the staff for various horticultural and agricultural papers. Material dealing with the experimental and plant breeding work being carried on at the Station is prepared each month for publication in the Ontario Fruit Branch Circular.

Exhibits.

Very successful exhibits were made during 1916 both at the local Beamsville Fair and at the Canadian National Exhibition, Toronto. These exhibits are so planned as to bring to the attention of the public and more particularly those

interested in fruit and vegetable growing, the work that is being carried on at the Station. A particular feature of the exhibit at the Canadian National was the display of peach jam, put up by the By-products Department of the Experiment Station. To those particularly interested sample jars of the jam were given together with printed instructions enabling them to make the jam themselves. Only a very small exhibit was made at the Canadian National in 1917.

Needs of the Station.

The lack of sufficient accommodation for farm help is being felt more acutely each year, especially in view of the fact that unmarried help is not available under present war conditions. Cottages have had to be rented for four of the laborers employed, and this besides costing an annual rental, is a serious inconvenience to the men who are sometimes required to work outside of the regular hours. It is difficult to secure and even more difficult to retain the desired class of labor when proper accommodation is lacking. The need for new cottages is therefore great, but will be relieved to some extent on the completion of a double cottage now under construction.

In addition to the need for new cottages, the Annual Report for 1915 made extended reference to other equipment in the way of buildings, etc., that was sorely needed. These buildings included increased greenhouse space, and a more commodious boarding house for single members of the staff, student assistants, stenographers and visitors. The greenhouses are now under construction and it is hoped that the boarding house will be built during 1918.

Sufficient land suitable for fruit growing has long been one of the great drawbacks to the successful carrying on of the various lines of work. This need has been permanently met by the rental of fifty acres of excellent land situated within working distance of the Station. A seven-acre property fronting on the Town Line and lying immediately in front of this fifty acres has been purchased outright.

Character of the Seasons of 1916 and 1917.

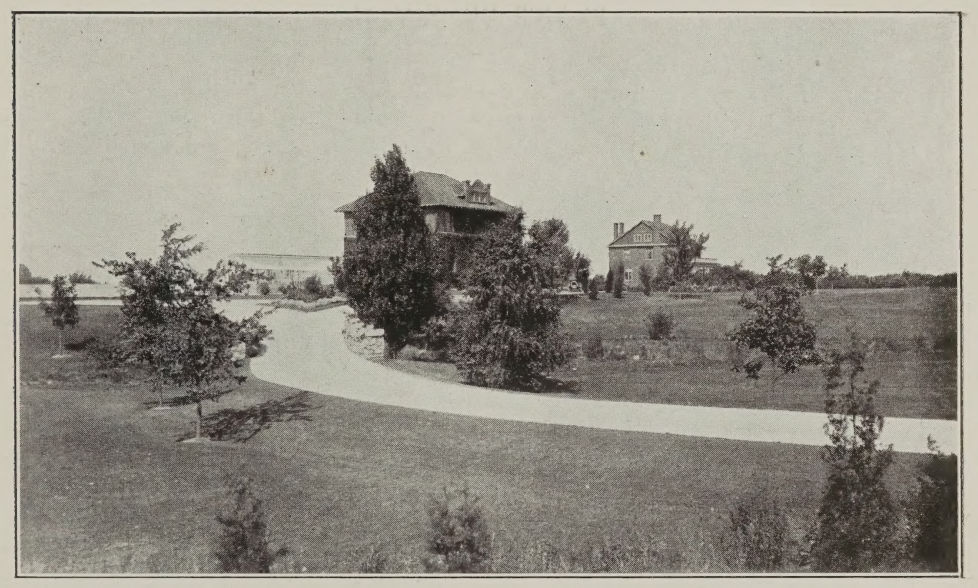
The character of the weather for 1916 may be said to have been quite remarkable for its extremes, but that of 1917 was even more so and considering our heavy type of soil was quite the most disastrous we could have experienced for our kind of work.

The winter of 1915-16 was comparatively mild during the first part up until Feb. 1st. The second frost of the season occurred on Nov. 11th, and there was no more than a few degrees of frost until the last day of December when the thermometer dropped to 12 deg. F. Zero was reached on the 17th of Jan., and then during the last ten days of the month the weather became very mild with heavy rains on the last two days taking away all the ice. February and March were typical winter months, the latter being especially stormy. The minimum temperature for the winter of 2 deg. below zero was reached on the 18th. There was a total snowfall of 22 in. in February, but March received the minimum monthly precipitation of .53 in. for the year. The snow stayed late and was not all gone by the first of April.

The winter of 1916-17 was longer and more severe. During November beginning on the 12th, there was two weeks of winter weather which then moderated for about two weeks and winter came again in earnest early in December with a temperature of only 4 deg. above zero on the 16th. There was a January

thaw which took away all the snow, but more came soon and we then had steady winter weather until the 7th of March. The minimum temperature for the winter was 7 deg. F., below zero on the 13th of February. The most of March was comparatively fine but with cold north winds. The month closed with a thunderstorm on the 23rd and fine, warm weather until the end of the month.

The chief features of the spring, summer and fall of 1916 were the extreme cold, wet, late spring followed by the extreme dry summer. During 1916, April, May and June were excessively wet and somewhat backward. The precipitation for those three months was 3.42 in., 4.93 in., and 4.57 in., respectively, or 12.92 in. for the spring months. The last frost recorded was a temperature of just 32 deg. F. on April 19th. The earliest blossoms to appear were on the 9th of May and it was not until the third week of May that the tree fruits came into bloom and then owing to the lateness of the season they all came at about the same time.



Experiment Station, driveway and Administration Building, 1916.

During 1917, April was cold but not so wet as the previous April, the temperature going down to 25 deg. F. on the 10th. The cold weather continued throughout May and commencing on the 16th an excessively wet period ensued until July 22nd. The wet of this season was even more disastrous than the previous season especially to the plant breeder. The precipitation for April, May, June and July, 1917, was 2.77 in., 3.38 in., 6.29 in., and 4.18 in., respectively, or 12.44 in., for the three spring months, followed by an excessively wet period of four inches more the first half of July. All fruits were very late in coming into bloom, it being June 1st before the peach bloom opened whereas they open about May 1st during a normal season. This retarded growth so much that there was danger of many fruits being caught with frost in the fall before they were mature which was actually what did happen. The first part of July was excessively wet—so wet in fact that there was more water on the land at that time than is usual even in the spring thaw. Then immediately when the rain ceased, we were subject to excessive heat which was doubly oppressive coming at

a time when the ground and atmosphere was saturated with moisture. The temperature went up to 96 deg. F. There was a normal rainfall for August, September and the first half of October, but during the latter half over 5 in. fell within ten days. This amount at this time did not cause any very serious difficulties as the land was able to absorb the most of it. It was much in contrast to the dry fall of 1916. It was immediately followed by cold weather with the winter of 1917-18 setting in with good sleighing early in December. The total precipitation for the year was not above the average, and in 1916 it was even below the average, but in both years it was very unevenly distributed.

Taken altogether the season of 1917 was full of extremes and unheard of excesses, and quite the most unsatisfactory year meterologically, on record.

PLANT BREEDING.

Plant breeding at the present time is and probably always will be the most important of the various lines of work being carried on at this Station. The amount of work with each fruit is growing steadily and the scope of the work is being gradually increased to include all our present commercial kinds of fruit;

Spy apple tree being used for hybridizing work. The paper bags which can be easily seen are used to cover the emasculated flowers to protect them against the introduction by winds or insects of pollen other than that applied by hand.

others which on account of lack of hardiness or some other limiting factor are not yet of commercial importance, but which will, it is hoped, ultimately prove of great value through plant breeding; and the many problems in hybridizing, germination of seeds, etc., which confront the plant breeder. Progress can be

only made on sound and fundamental foundations. As our experience increases, we learn through mistakes we have made, of indispensable requirements for the successful continuance of the work, and each year sees some definite results attained which serve as a guidance for the further carrying on and enlargement of the work. In the past certain phases of the breeding have been carried on under extreme difficulties and the experience so gained would indicate that such work would better be discontinued until equipment is available with which to overcome these difficulties.

In analyzing the past five seasons' work in hybridizing the stone fruits out-of-doors, the conclusion has been reached that out-of-door methods for these fruits so militate against successful results that continuation of this method would be very discouraging and in no way commensurate with the efforts put forth. Hybrids and seedlings must be grown in large numbers to expect any reasonable progress in the improvement of varieties through plant breeding.

Scientific investigation in plant breeding must go hand in hand with the work for practical results. Oftentimes, a little investigation clears the way for far better and quicker results. Investigational work in seed germination needs greatly to be done to determine the best methods of handling and germinating the many different kinds of fruit seeds after they have been secured through painstaking hybridizing work. Again, the knowledge that self-sterility in grapes is due to the degeneration of the sex cells in the pollen grain (*M. J. Dorsey*) has eliminated the necessity of emasculating the self-sterile varieties when using them as female parents (thus avoiding a great amount of laborious work) and makes evident the futility of using the pollen from these self-sterile varieties on other varieties or on their own flowers. Incidental work at this Station with Greensboro and Dewey peaches, two of the best early commercial varieties, has shown that their seeds are not viable and hence precludes their use as female parents or in the securing of self-fertilized seeds.

These incidents are given to show the necessity for broadening the scope of the plant breeding work so that scientific investigation may work hand in hand with practical work. All the work heretofore has been of a practical nature only, owing to lack of facilities and equipment, insufficient trained assistance, and funds to extend the work to what it should include. If sufficient money were available investigational work would be given the time and prominence that it deserves, to the, needless to say, great advantage of the work in hand and hence to the fruit interests of the Province and Horticulture generally.

As mentioned at the beginning of the Plant Breeding Report one of the chief activities of the Experiment Station is the production of new and better varieties and improved types of old varieties of fruits either by hybridizing or through selections of present varieties. Another way which it has been practically impossible to attempt yet but undoubtedly one of the ways in which future improvement will take place is through the selection of desirable bud variations, though it would be unreasonable to expect to achieve by this method the almost spectacular results which have attended the bud selection work of Shamel with citrous fruits in California. Our fruits apparently are not as variable as are the citrous fruits and therefore do not lend themselves so readily to improvement through bud selection. Nevertheless, to use specific examples, it has often been observed that there are at least two distinct types of the Northern Spy apple, one of which from its more attractive conical shape, distinctly higher color, and better keeping quality is much more desirable commercially than the other. To mention another instance, a Bartlett pear tree was observed in the fall of 1916

which bore normal fruit on all of its branches but one, and on this branch the fruit was russeted over completely presenting in color very much the appearance of the Bosc pear. The fruit was normal in every other way, size, shape, flavor and season, in fact, a Bartlett in every regard except as to color.

Similar variations to those mentioned above no doubt exist in a more or less marked degree in all our cultivated fruits. It only remains for a man sufficiently trained with regard to varieties and with regard to the probable

No. 1 illustrates apple blossoms emasculated (male reproductive organs removed). No. 2 shows blossoms in right stage for emasculation—before the blossoms open. No. 3, bud cut open showing right stage for emasculation. No. 4, blossoms open—too late for emasculation. Note how the mature stamens surround the pistil.

commercial value of such variety variations, to make it his work to discover such variations, using the whole of Ontario, and more particularly the Niagara District as his hunting ground. Quicker results may possibly be looked for from this method and the finding also of good chance seedlings (one or two such we have already accidentally found and are propagating for further trial) than by having to wait for definite hybrids, especially of tree fruits, to come into bearing. The limiting factor in such work as outlined briefly in the foregoing paragraphs, is of course the lack of necessary funds.

The Work in Apple Breeding.

From the breeding work here and research work at Macdonald College we have the following growing in Section 1 ready to set out in the spring of 1918:—

Table 1.—Apple Hybrids.

Cross.	Number Seeds planted, 1915.	Number Seeds germinated.	Number alive September, 1917.	
Spy x Ben Davis	24	15	12	
Spy x Wealthy	53	12	10	
Spy x McIntosh	26	8	8	
Spy x Duchess	21	7	6	
Spy x Fameuse	13	2	2	
Fameuse x McIntosh	.....	78	58	Received from Macdonald College. The results of research work.
McIntosh x Wealthy	.....	27	21	
McIntosh x Milwaukee	.....	13	9	
McIntosh x Fameuse	.....	4	4	

During the period in which the 1917 breeding work on apples was done the weather was more or less disagreeable.

By June 1st the buds were showing pink and in many places were opening. Emasculating was started and was done on June 1st, 2nd, and 4th. The young trees in Section 7 which were the fartherest advanced were ready to pollinate June 4th and with these a 4.9 per cent. set was obtained. This was very poor as on only one out of five trees did we get a fair set, 15.3 per cent. Two others gave one fruit each out of 111 and 122 pollinations while the remaining two gave nothing out of 137 and 22 pollinations respectively.

The pollen used was fresh having just been gathered long enough to burst before being used. Immediately after this the weather became cold and wet and the vitality of the pollen may have been injured. This subject of cold injuring the vitality of the pollen is one on which there has been considerable written during the last year in several fruit papers, showing, over a long period of years, how cold wet weather at blossoming time had frequently spoiled the fruit crop.

The cold wet spell stopped June 9th and pollinating was immediately done in Section 3. The buds had been emasculated since the 2nd and 4th but still looked receptive. The cold had so retarded the bloom that it had scarcely opened any since the 4th. Three fruits set out of 953 pollinations but these dropped shortly after.

Cherries.

Seedlings: The seedlings grown in 1915 were transferred in the spring of 1916 from the nursery row to a permanent plantation, but unfortunately most of them died. Many died in storage during the winter and many more never survived transplanting. At present, only 7 Elkhorn, 7 Late Duke, 5 Coe's Transparent, 6 Cherry No. 5 and 1 Windsor seedlings are growing out of 1,252 seeds which originally germinated and which represented eleven varieties.

A large number of seeds were secured during 1915 and were planted in beds

out-of-doors in Section 1. The germination again was exceedingly poor as shown in the following table:—

TABLE II.—GERMINATION OF CHERRY SEEDS SECURED IN 1915.

Variety.	Planted.	Germinated.	Growing, Fall, 1917.
Windsor	6,400	1	.....
Montmorency	6,000	138	45
Late Duke	2,800	16	15
English Morello	2,500	36	21
Black Tartarian	600	.....	.....

This work was repeated in 1916 and 1917 but the seeds were given cold frame treatment in the spring rather than being planted outside in beds. To date no count of the germination has been made but in most cases it has been quite good. The following list gives the number of seeds planted:—

1916		1917	
Black Tartarian	2,059	May Duke	1,160
Napoleon	3,120	Lewelling	1,434
Windsor	3,503	Napoleon	1,179
Reine Hortense	415	Windsor	1,696
Late Duke	620	Black Tartarian	423

A number of buds of the Abundance and Burbank cherries were received from Mr. Geo. A. Robertson, St. Catharines. These have been inserted in tree 2, row 7, Section 6.

Hybrids: The past year 1917, the breeding of cherries was carried on for the first time and we secured, all things considered, very fair results. We have yet to see how the seed will germinate.

Following is a list of the crosses made and the results obtained:—

TABLE III.—1917 CHERRY HYBRIDIZING.

Cross.	Number Pollinations.	Number Fruit Set.	Number Gathered.	Number Saved.
	sacks	sacks	sacks	sacks
Black Tartarian x Napoleon	41	54	47	18
Napoleon x Black Tartarian	32	97	62	25
Olivet x Windsor	23	20	18	13
Windsor x Black Tartarian	13	24	24	19
Windsor x Rockport	13	32	29	16
Montmorency x Napoleon	58	163	121	106

The number of fruit set is small due to the weather being very cold and backward at that time. A period of about a week elapsed between emasculating and pollinating so that many of the pistils dried up. Ten blossoms were usually included under each sack.

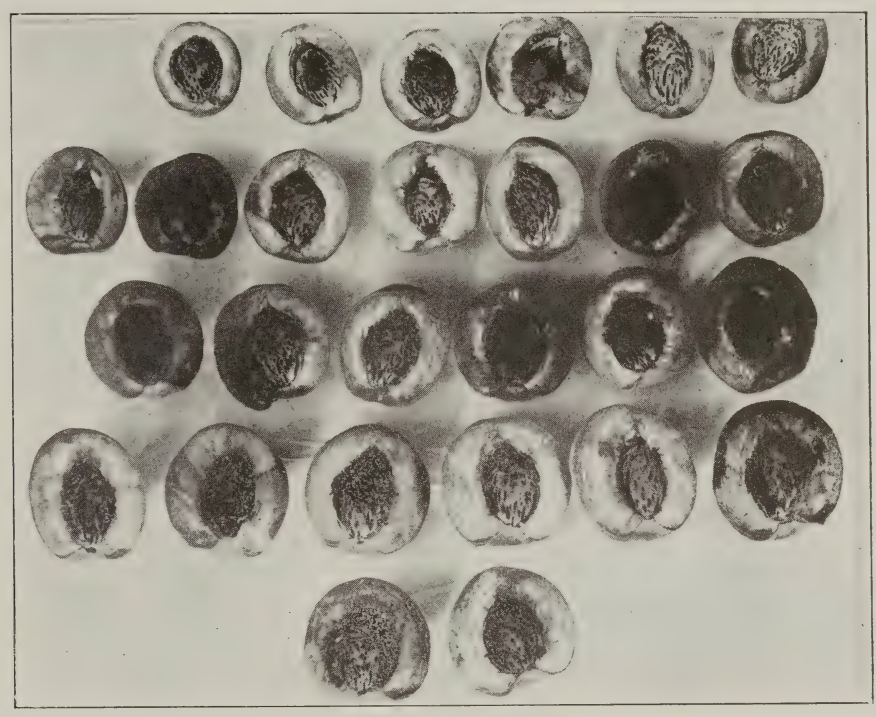
In column "Number Saved" we have a record of the pits which sank in water and which were therefore saved and planted. In washing cherry pits it has been found that those which float contain only a dried up kernel and are therefore worthless.

PEACHES.

Seedlings: All of the seedling peaches which were planted in 1911 fruited during 1916 and 1917 and have been described. Those thought worthy of further

trial have been retained, the remainder removed. Those of this lot that were formerly thought to be New Prolific seedlings are undoubtedly Elberta seedlings, as shown by their similarity with each other and with the Elberta type of peach.

Elberta seedlings are all, with one exception, of the Elberta type—somewhat oval—and not very highly colored. The pits also are all of the Elberta type—corrugations being somewhat smoother than in other peaches and the pits being long and somewhat flattened. Those in the illustration where the pits are not distinct, are cling-stone. Each half peach represents one seedling. The two half peaches at the bottom of the illustration (Fig. 6) are the Elberta variety itself.



Elberta seedlings. Each half section represents a different seedling. The two half peaches at the bottom are the Elberta variety itself. One seedling in particular is very promising.

The Elberta seedlings show very encouraging results from the few that have fruited. Out of a total of 28 trees, 16 fruited in sufficient quantity for the fruit to be described and of these eight or 50 per cent. were of better quality than the Elberta itself. Twenty-five trees bore fruit and of these, 25 per cent. were equal to the Elberta in size, but were not so good in color.

One of the Elberta seedlings in particular is worthy of further trial. The fruit resembles the Elberta variety itself in many ways as regards size, shape, color, flesh, etc., but is of a distinctly higher quality and possibly two or three days earlier in season.

In the accompanying illustration the large fruit at the top is St. John and those in the row immediately below it are seedlings of St. John. The St. John type is evident in the pit, but the fruit is all smaller and very much later in season. The other row represents seedlings of an unknown origin, but they,

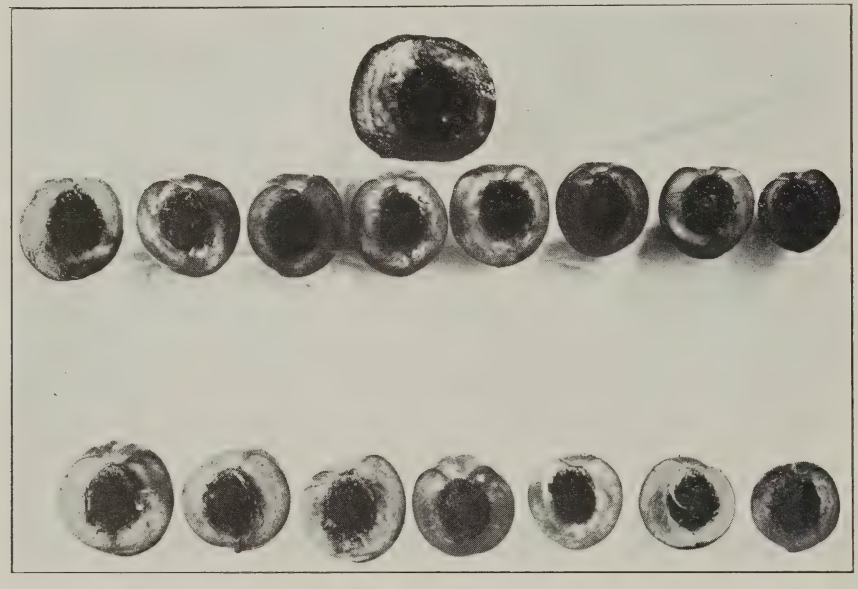
in all probability, are St. John seedlings, too. They are small and late and of no commercial value. Each half peach represents a seedling.

The St. John seedlings are all uniformly freestones. The fruit is all small and very much later than the St. John, being ripe in the same season as the Elberta (September 28th, 1916).

Of the block of 1,000 Early Crawford seedlings which were planted in 1913, 343 fruited during 1917. Fourteen of these ripened their fruit before September 25th, of which number only three were considered worthy of further trial.

Ten of these which ripened before September 25th had white flesh, the other four had yellow flesh, as did nearly all those which ripened later.

No others were ready until October 10th and these had all been touched by the frost of October 7th and 9th causing them to be very mealy and tasteless so



The large fruit at the top is St. John, and those immediately below are St. John seedlings. The parentage of the bottom row is unknown, but is probably St. John also.

that very little idea of flavor could be gathered. Twenty-nine were removed at this time as being too small and of poor quality. There were also 67 which at the above date had not begun to ripen and which were therefore removed as being far too late in season to be of commercial value.

This block of peaches was planted 7 ft. by 7 ft. which distance has been found to be insufficient. Every third row running north and south was therefore removed in the fall of 1917 so that the remainder might have a fair chance to fruit. There are now 512 trees left.

In one block of peach seedlings, mostly Elbertas, planted in 1914, only eight or nine bore fruit and only in small quantity. In another block of Elberta seedlings of 107 trees, 83 bloomed in spring of 1917 and in these seedlings there was a very noticeable breaking up in the type of blossom—Elberta is supposedly the result of a Chinese Cling and Early Crawford cross. The Chinese Cling type is an example of the large flowered peaches while the Crawford is an

example of the small flowered peaches. The Elberta has a medium sized flower. In the above seedlings then we have the F_2 generation of the Chinese Cling x Early Crawford. The breaking up in blossom type was as follows: —

Those with small pink flowers	57
Those with large white flowers	26
Those yet to bloom	24
	107

From the numbers which have already blossomed we do not get any definite ratio but if the most of the remaining 24 were to show pink we would then have a very good 1-2-1 ratio. The further blossoming of these Elberta seedlings is being looked forward to with considerable interest.

Of the 5,298 seedlings of the following varieties planted in 1915 approximately 4,500 are still alive and in nursery rows to be planted out in the spring of 1918:—

Elberta	935	Lemon Free	1,402
Longhurst	1,004	St. John	160
New Prolific	865	Jacques Rareripe	150

This block of seedlings presents a very uniform lot and has done well. The constant rain in the spring caused a few to succumb to wet feet and retarded many others. Later the Brown Rot fungus, *Sclerotinia cinerea,* attacked a good many which were at once pulled up and removed but even with these handicaps a very promising block remains.

During 1917 the following open fertilized seed was saved and planted:—

	Number		Number
Arp Beauty	543	Reeves Favourite	359
Leamington	323	Leamington selfed, Sec. 9, Row 3, T. 1	110
St. John	226	" " " " 17	71
Elberta, Lot 1	149	" " " Row 4. T, 21	17
Elberta, Lot 2	75	" " " Row 4, T. 11	42
Longhurst	410		

Elberta Lot 1 differs from Lot 2 in that Lot 1 was picked as for commercial shipping. Lot 2 ripened on the tree, the object being to try and ascertain if the picking of fruit green has any effect on the germination of the pits.

The four lots of Leamingtons selfed are the seeds from the most promising of these hybrids in Section 9.

With these were also layered a large number of Dewey and Greensboro pits, and their behaviour repeats the experience of several seasons' attempted work with these two varieties. The Greensboro seeds were all shrivelled and decayed when examined in the spring; the Dewey, while they were in a little better state of preservation, failed absolutely to grow on being planted.

Peach Hybrids: A good proportion of the peach hybrids of 1913 breeding fruited this year and all which were not promising in some respects were at once removed. Cling-stone, poor quality, a marked deficiency in color or size, susceptibility to rot or other diseases, and extreme lateness were the general causes for which most were removed. Anything promising either commercially or for further breeding work was left for further trial. Table IV shows the 1913 hybrids which have fruited and those which have been removed.

TABLE IV.—SUMMARY OF FRUITING OF 1913 PEACH HYBRIDS.

Cross.	Number of Trees.	Number Fruited.	Number Removed.	Remarks.
Early Crawford x Greensboro	15	8	2	1 bitter, 1 very poor.
Elberta x Early Crawford	7	6	.....	
Millionaire selfed	3	.....	.....	
St. John x Sneed	3	1	1	Very poor.
New Prolific selfed	16	9	9	Very late.
Leamington selfed	57	52	39	Small, fuzzy, poor quality.
Fitzgerald selfed	21	3	.....	
Late Crawford selfed	4	.....	.....	
Early Crawford selfed	4	.....	.....	
Elberta selfed	9	.....	.....	
Crosby selfed	4	.....	.....	
Golden Drop selfed	3	.....	.....	
St. John selfed	6	.....	.....	
Klondyke selfed	11	1	1	Late, small, poor.
Total	163	80	52	

Triple bud formation, Greensboro.

Single bud formation, St. John.

To date, Leamington selfed is the only one of which the majority of trees have fruited, and this gave us several interesting seedlings.

For the most part the fruit was white-fleshed and almost identical with the parent, differing only in season, some coming much earlier, Aug. 28th, to much later, Oct. 10th. The Leamington itself ripened Sept. 15th this year, 1917.

Upon making inquiries *re* the history and origin of the Leamington peach,

Mr. J. W. Noble, District Representative of Essex County, was able to furnish us with the following information:—

"The Leamington peach originated on the farm of George Mills, Leamington, Ontario, about twenty years ago. Mr. Mills is now deceased. It is a seedling of the Tyhurst seedling, white-fleshed, freestone, good quality and ripens a short time after Yellow St. John. It is not grown to any extent here on account of its white flesh."

The Tyhurst seedling is yellow-fleshed which accounts for the seven yellow-fleshed peaches showing up in the Leamington selfed.

Of the New Prolific selfed which fruited all were extremely late in season and were therefore removed.

In the Elberta x Greensboro cross eight trees fruited, all of which bore large freestone white-flesh fruit, six of which were left.

Crossing work was carried on with peaches again during 1916 and 1917. The oiled cotton tent to cover the whole tree was given further trial in the 1916 season's work. In 1915, it was found that very high temperatures were maintained under the tent when the sun was shining directly on it, and in view of the poor results obtained, it was conceded that these temperatures were too high for the setting bloom. The following two tables of observations made on the tent used in 1916 indicate the same thing.

TABLE V.—ELBERTA PEACH TREE UNDER OIL COTTON TENT, 1916. EMASCULATED MAY 13TH, POLLINATED MAY 19TH AND 20TH, WITH YELLOW SWAN VARIETY. OBSERVATIONS, 717 POLLINATIONS.

Date.	Time	Temp. near Roof.	Temp. near Ground.	Temp. Outside.	Atmospheric Conditions.
May 13...	Noon	100 F	90 F	70 F	Bright, calm and clear. Air in tent smells very much of oil and is stifling.
May 17...	10 a.m.	56	55	52	Cloudy and cool.
May 19...	3 p.m.	65	65	60	Warmer but stormy. Thunderstorm.
May 20...	10 a.m.	80	66	52	Fine and bright, becoming warmer.
May 24...	10 a.m.	90	80	75	Fine and warm, becoming hot. In afternoon tent much hotter.

TABLE VI.—SUMMARY OF 1916 WORK AND COMPARISON OF TENTS AND SACKS.

Cross.	No. Poll.	No. Fruits set.	No. Fruits gathered.	Remarks.
Elberta x Yellow Swan	717	?	102	Oiled cotton tent used.
Early Crawford x Dewey.....	337	96	78	Sacks used.
St. John x Dewey	284	94	55	Sacks used.

In the plant breeding work for 1917 the conditions were rendered very unfavorable by continued cold and wet weather. Emasculating was done, but rain combined with heavy wind in many cases either broke off the bags or injured the pistils to such an extent as to render them useless. This being the case, on the appearance of a fine day (May 30th) before the trees were in full bloom, buds were selected which from all appearances would be fully open next day. These buds were then emasculated and pollinated at once.

The anthers in these buds did not show any signs of having burst and while no special work was done to see if this was the case we considered it safe enough to carry on such work.

A very important point to be considered in future work in the peach breeding is this: In peaches there are two types of buds, (1) The triple bud formation—two blossoms and a leaf bud. This gives an abundance of bloom and an even distribution of foliage, e.g., the Greensboro. (2) The single bud formation in which there is a scarcity of foliage along that portion of the branch where most of the fruit is borne, e.g., St. John. The accompanying illustrations will serve to make these two types of bud formation clearer.

Peach Buds ready for emasculation at top, emasculated below.

When emasculating blossoms in the past we have been rather free with the knife cutting back until good flower buds were obtainable. While working with trees having the triple bud formation this method is practicable, but as several of the better varieties we are using in the breeding work have the single bud formation care will have to be taken in cutting back because such cutting back in varieties or twigs having the single bud formation removes a large percentage, if not all, the leaf surface from the twigs worked with, the consequence being that the resultant fruit is poorly nourished, and while many set very few reach maturity.

The 1917 breeding work in peaches is given in the following list:—

TABLE VII.—1917 PEACH HYBRIDIZING.

Cross.	Number Pollinations.	Number Fruit gathered.
St. John x Arp	86	12
St. John x Early Crawford	126	22
St. John x Mayflower	50	26
Elberta x Greensboro	93	18
Elberta x St. John	93	18
Early Crawford x Arp	89	17
New Prolific x Greensboro	49	12
New Prolific x Early Crawford	31	6
Arp x Mayflower	100	36
Arp x Early Crawford	100	48
Arp x Elberta	100	65
Arp x St. John	100	53
St. John x Mayflower	50	26
St. John selfed	150	6
Elberta selfed	197	27
Mayflower selfed	120	4
Triumph selfed	97	.....
Early Crawford selfed	148	19
New Prolific selfed	121	10
Arp Beauty selfed	100	33
Elberta Seedling selfed	200	78
	2,200	556

A block of seedlings, showing poor germination under field conditions.

PEARS.

Seedlings: The seedlings of Kieffer, Flemish Beauty and Bartlett previously reported on are now planted at fruiting distance in Sections 8 and 9, and are all making satisfactory growth. A large number of pear seeds were planted in the fall of 1915 in the same area with the cherries and plums in Section 1. As with the cherries and plums, poor germination was obtained; 141 seeds germinated from 7,200 planted of the varieties Kieffer, Anjou and Clairgeau.

Seeds in large quantities were obtained and planted in the fall of 1916, for a repetition and extension of the 1915 work. These seeds were planted in flats and given cold frame treatment in the spring of 1916, since with the seeds of woody plants our experience has forced us to seek new methods of germinating these seeds, though at the Central Experimental Farm, Ottawa, they have found that under their conditions seeds will germinate quite as well by being planted directly in the nursery row in the open field in the fall. Following is a list of the varieties and number of seeds planted and the number now growing:—

	No. Seeds Planted.	No. Growing 1917.		No. Seeds Planted.	No. Growing 1917.
Bartlett	1,376	1,150	Woolverton Seckel	2,394	1,764
Clairgeau	642	479	Sheldon	408	168
Anjou	1,034	349	Bosc	487	383
Louise Bonne	503	284	Le Conte	1,174	785
Giffard	100	96	Kieffer	544	285
Flemish Beauty	1,529	942	Duchess	1,668	1,387
Goodale	1,602	1,230	Mount Vernon	676	158
Lawrence	690	504			
			Total	14,827	9,964

As will be readily seen an excellent germination was secured by the use of cold frames:—

The following seeds were planted in the fall of 1917:—

Giffard	2,825	Seckel	560
Clapp's	489	Anjou	1,020
Flemish Beauty	850	Bartlett Lot 1 (picked commercially)	1,000
Duchess	255	Bartlett Lot 2 (ripened on tree)	525

Hybrids: The seeds obtained from crossing work in 1915 were planted individually in pots and were then transplanted to nursery rows in Section 1. In the spring of 1918 they will be transplanted to permanent fruiting quarters. In table VIII is given the number of seeds originally planted, the germination, and the number of plants at present growing. The germination was better than would be indicated in this table as a large percentage of the young plants succumbed to "damping off" in the excessive wet spring.

TABLE VIII.—PEAR HYBRIDS OF 1915 WORK.

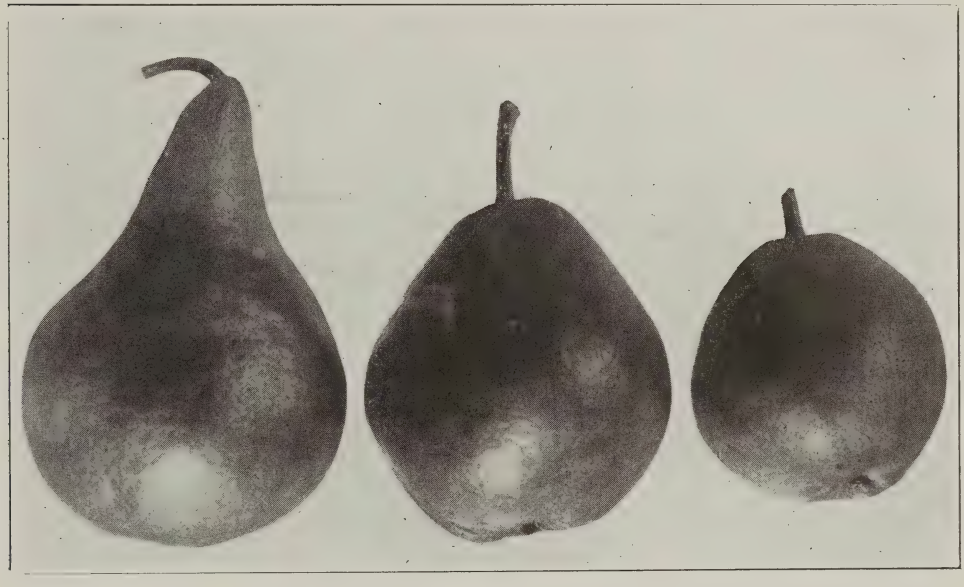
Cross	No. Seeds Planted	Germination	Alive Sept. 1917
Duchess x Bessemianka	21	15	14
Duchess x Clapp's	7	2	2
Duchess x Kieffer	13	3	3
Duchess x Anjou	8	2	1
Duchess x Sheldon	29	2	2
Duchess x Tonkavietka	20	11	8
Duchess x Bosc	1	0	0
Clapp's x Comice	15	1	1
Bartlett x Tonkavietka	74	36	30
Bartlett x Gliva Kurskaya	2	0	0
Bartlett x Sheldon	30	10	7
Bartlett x Bosc	171	55	49
Bartlett x Anjou	162	21	20
Bartlett x Bessemianka	50	16	14
Bartlett x Clapp's	39	8	8
Bartlett x Kieffer	20	4	4
Bartlett selfed	2	2	1

No crossing work was done with pears during the season of 1916 owing to the absence for military reasons of the Hybridist during the blooming period.

During 1917, 3,056 pollinations were made, but weather conditions were very unfavorable for the setting of fruit. Only 67 fruits set and 54 were finally gathered.

Zenia in Pears: In the Bosc x Clapp's Favorite crosses different types of fruit resulted. Two of the fruits resembled Bosc, while three were intermediate in type between the two other types present in the accompanying illustration.

When the fruit was being cut to remove the seeds there was a decided difference in texture, the Bosc was quite tender whereas the others were very gritty, coarse and seemed contracted. In this case it would seem as though the pollen had some influence on the fruit as the fruit all came from one Bosc tree and except for the two like Bosc the others closely resembled Clapp's, but ripened with Bosc.



Zenia in pears, Bosc and Clapp's Favorite.
(Slightly reduced.)

Plums.

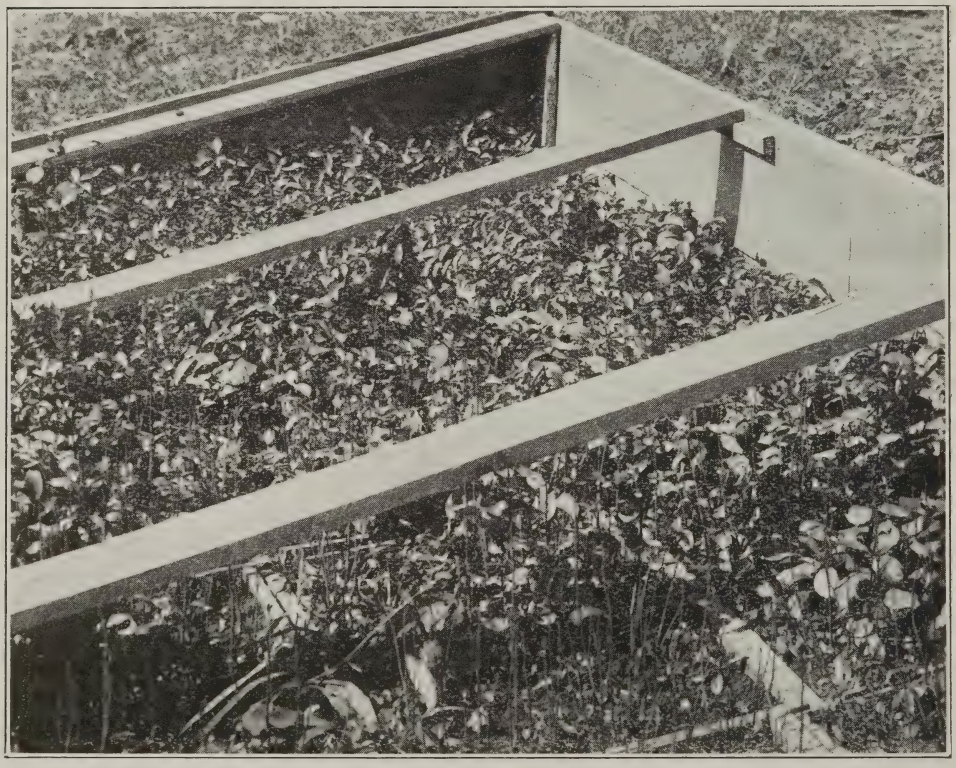
Seedlings: The seedlings planted out in 1915 have been moved to permanent fruiting quarters in Section 8, and are making satisfactory growth. The seeds planted directly in the field in the fall of 1915 gave very poor germination. This, no doubt, was due to the unfavorable weather conditions in the spring and now that additional cold frames are available for this work, it is hoped that more satisfactory results will be obtained. The accompanying illustration shows the poor stand of seedling plants secured when it is considered that the seeds were planted in squares about one inch apart over the beds.

Table IX gives the list of seeds planted in 1915, the germination and the number now living and to be transplanted in the spring of 1918:—

TABLE IX.—GERMINATION OF PLUM SEEDS PLANTED IN 1915.

Variety	Number Planted	Germination 1916	No. Alive Sept. 1917
Yellow Egg	2,100	0	0
Pond's Seedling	3,000	25	24
Coe's Golden Drop	1,500	340	218
Washington	500	0	0
Gueii	600	0	0
Shiro	1,600	20	16
Burbank	2,000	0	0
Lombard	4,000	162	148
Riley Damson	600	60	43
King of the Damsons	1,000	16	16
Apricot	2,500	190	57
Total	19,400	813	522

Over 14,000 plum pits of the varieties: Shiro, Washington, Gueii, Yellow Egg, Lombard, German Prune, Pond's Seedling, Reine Claude and Duane Purple were collected in 1916, planted in flats, and buried two or three inches in cold



Excellent germination of seed has been secured by the use of cold frames rather than planting the seeds in the open field.

frames. In the spring, they were given cold frame treatment and a good germination secured (3,431). These will be planted out in nursery rows in 1918.

Some 5,150 pits, representing ten of our leading commercial varieties have been saved and planted in cold frames. In washing these pits after they have been extracted from the pulp it was noticed that several seeds floated. In the case of Gueii about 75 per cent. floated, while in others the number was much less and some had no floaters. Several of the pits which floated were cracked and in no case was the kernel fully developed while in many cases it was completely shrivelled. The seeds which sank had full plump kernels.

The floaters were separated from the sinkers and planted separately. Many of the floaters were useless but as some were a half or more filled out, these were treated as good ones to see if germination would take place. If none of these floaters germinate, in future all that will be necessary will be to separate them and plant only the sinkers.

Hybrids: The following were transplanted to permanent fruiting quarters in the spring of 1917 and are making satisfactory growth:—

Greengage x Lombard 2
Coe x Grand Duke.....3
Washington x Grand Duke.....1
Lombard x Yellow Egg 8
Lombard x Grand Duke.....2
Lombard x Hand.....1
Lombard x Coe.....2

Table X gives the results of the hybridizing work of 1915. These pits were planted at the end of the winter season in the greenhouse and there are still some seeds remaining dormant in the soil and which are, to all appearances, still in good condition. They may germinate later. Those which germinated are in nursery rows, Section 1, and will be transplanted to fruiting quarters in the spring of 1918.

Table X.—Germination of Plum Pits from 1915 Breeding.

Cross	No. Pits Gathered	No. Pits Planted	Germination	Alive Sept. 1917
Reine Claude x Coe	5	5	0	0
Reine Claude x Yellow Egg	4	4	0	0
Washington x Yellow Egg	8	8	1	1
Washington x Coe	12	10	0	0
Lombard x Hand	49	48	20	5
Lombard x Grand Duke	65	65	8	7
Yellow Egg x Washington	12	11	4	2
Yellow Egg x Reine Claude	1	1	0	0

The breeding work with plums in 1916 was confined to an endeavor to self-fertilize the Shiro, which was unsuccessful, and to crossing the Shiro with *P. simonii*. Nine hundred and twenty-four pollinations in all were made which yielded 15 fruits from the cross.

In 1917, the work with plums was reduced as past experience has demonstrated that outdoor breeding of plums is a waste of effort. The 1917 work consisted in an endeavor to self-fertilize four varieties—Gueii, Reine Claude, Washington and General Hand. Gueii and Reine Claude yielded 77 and 7 fruits respectively. Washington and General Hand failed to set any fruit. One thousand one hundred and sixty-four blossoms in all were covered.

Grapes.

Many of the hybrids of the 1913 breeding fruited during the 1917 season. The fruit was in all cases described roughly, and those vines which gave considerable promise were retained. The remainder were removed at once.

The results on the whole from the grape breeding have been distinctly encouraging. Several hybrids of considerable promise have been found, though only 237 vines out of the 815 total have fruited. In seedlings of which only the maternal parent is known 344 vines fruited and there are 1,624 yet to fruit. The results here have also been encouraging. No attempt will be made in this report to describe any of the better hybrids or seedlings secured, but in another season or two we will be better able to judge as to the merits of the vines saved and report will be made at that time.

In general the chief reasons for which vines were removed were as follows:—

(1) A great many had a large, too firm centre to the fruit which it was impossible to swallow or could be swallowed only with considerable difficulty.

(2) A few had reverted. Fruit small, hard.

(3) A few were very late, so late that they could never be of commercial value as they would seldom mature.

(4) Some were very acid.

(5) Size caused several others to be removed. Unless a berry had some decidedly good qualities to make up for the lack of size it was removed.

(6) In some the pulp had no character at all, it was simply mush and tasteless.

(7) Lack of sufficient vigor in the vines.

With regard to the 1914 hybridizing work, particulars of the germination and number of vines transplanted were given in the 1915 report. There have been, of course, a considerable number of casualties during the past two years, as is shown by the following figures: Of 40,129 hybrid seeds planted in April, 1915, 4,431 germinated, and were transplanted to the field. At the present time, 1,900 plants are growing. In addition, 176,386 seeds of which only one parent is known, were planted in April, 1915. Ten thousand six hundred and forty-three, or 6.03 per cent. of these germinated and were transplanted in 1916. This number has been reduced by casualties to 2,539 at the present time. It is only fair to say that the great mortality has been chiefly due to the very unsuitable soil and site on which it was necessary to plant the small seedlings and hybrids. Fortunately, there is much good land available for future work so that we shall be able to avoid such discouraging losses.

The seeds obtained from the 1915 hybridizing work were planted individually in thumb pots and were held over the winter of 1916-17 in the same pots in the greenhouse. Past experience had shown that young grape seedlings would not stand transplanting from flats when very small, hence the planting of 1915 seeds in the thumb pots. Table XI gives the germination and the number now growing of the 1915 crosses: These are at present in nursery rows in Section 1 from where they will be transplanted to permanent fruiting quarters in the spring of 1918.

TABLE XI.—GRAPE SEEDS OF 1915 BREEDING PLANTED NOVEMBER, 1915.

Cross	Number Seeds Planted	Number Germinated	% Germination	Number Growing July, 1916	Number Growing Sept. 1917
Niagara x Herbert	5	.....	.....	.....	.....
Niagara x Delaware	139	31	22.30	27	.....
Niagara x Catawba	17	3	17.64	.....	.....
Niagara x Agawam	233	45	19.31	39	.....
Niagara x Vergennes	28	9	32.14	6	.....
Niagara x Concord	318	90	28.30	66	6
Niagara x Black Hamburg	63	39	61.9	32	2
Niagara x Muscat of Alex	16	.....	.....	.....	.....
Niagara x Champion	63	35	55.55	31	.....
Niagara x Campbell	354	198	55.93	157	3
Campbell x Agawam	36	7	19.44	7	.....
Campbell x Black Hamburg	64	7	10.93	7	.....
Campbell x Delaware	32	9	28.12	6	.....
Agawam x Concord	1,388	432	31.12	370	5
Agawam x Niagara	1,293	497	38.43	476	83
Agawam x Campbell	157	57	36.30	45	2
Agawam x Delaware	28	4	14.28	3	.....
Lindley x Campbell	416	303	72.82	264	9
Lindley x Moore	127	98	77.16	92	11
Lindley x Champion	235	179	76.17	161	102
Lindley x Concord	512	380	74.21	336	16
Lindley x Delaware	103	64	62.13	55	20
Lindley x Niagara	482	300	62.28	263	114
Lindley x Worden	991	717	72.35	637	239
Salem x Concord	174	33	18.9	32	7
Salem x Champion	23	7	30.43	7	.....
Salem x Niagara	82	21	25.60	20	.....
Salem x Worden	.....	280	.....	190	100
Wilder x Campbell	47	13	27.65	12	3
Wilder x Concord	25	11	44.00	11	1
Wilder x Champion	4	2	50.00	1	2 ?
Wilder x Delaware	38	11	28.94	11	4
Wilder x Worden	46	22	47.82	19	14
Wilder x Niagara	92	39	42.39	38	8
Massasoit x Concord	.....	200	.....	122	91
Massasoit x Delaware	91	30	32.96	23	20
Massasoit x Worden	.....	163	.....	149	52
Vergennes x Campbell	.....	387	.....	134	80
Vergennes x Delaware	.....	320	.....	204	79
Vergennes x Champion	.....	320	.....	284	55
Vergennes x Niagara	.....	208	.....	52	14
Vergennes x Worden	.....	284	.....	180	73
Vergennes x Concord	.....	480	.....	391	65
Isabella x Concord	65	22	33.84	22	9
Isabella x Niagara	8	1	12.5	1	.....
Catawba x Niagara	96	25	26.04	20	2
Muscat of Alex. x Catawba	11	.....	.....	.....	.....
Banner selfed	.....	200	.....	130	42
Caco selfed	.....	40	.....	26	7
Charlton selfed	25	9	36.00	8	3
Chasselas avec Royal selfed	.....	80	.....	46	5
Colerain selfed	63	15	23.80	14	1
Winchell selfed	135	13	9.62	13	1
Early Ohio selfed	.....	80	.....	40	14
Elvira selfed	.....	120	.....	75	39
Green Early selfed	.....	420	.....	271	67
Hartford selfed	118	2	1.70	2	1
Hermann Jæger selfed	.....	120	.....	69	7
Hicks selfed	128	34	26.56	32	2
Iona selfed	.....	160	.....	79	14
Isabella selfed	47	.....	.....	.....	.....
King selfed	.....	40	.....	23	5
Lutie selfed	.....	120	.....	104	10

TABLE XI.—GRAPE SEEDS OF 1915, BREEDING PLANTED NOVEMBER, 1915.—*Continued.*

Cross	Number Seeds Planted	Number Germinated	% Germination	Number Growing July, 1916	Number Growing Sept. 1917
Manito selfed	.....	40	.....	11	4
McPike selfed	.....	160	.....	102	21
Niagara selfed	.....	40	.....	15	8
Pense Malaga selfed	56	.....	.....	.....	.....
Perkins selfed	.....	363	.....	215	114
Wilkins selfed	.....	60	.....	45	19
Vergennes selfed	.....	1,042	.....	730	421
Agawam selfed	250	32	12.80	32	.....
Campbell selfed	.....	360	.....	223	26
Concord selfed	.....	320	.....	179	105
Duchess selfed	.....	7	.....	7	4
Eaton selfed	.....	3	.....	3	.....
Pierce selfed	.....	14	.....	14	10
Worden selfed	.....	27	.....	27	15
Diana selfed	.....	10	.....	10	5
Total	.....	10,314	.....	7,548	2,261
Total, exclusive of those where the number planted was not known	8,724	3,846	44.08	.....	.....

A study of the above table reveals the fact that the mortality in the young grape seedlings has been as bad if not worse, as in the previous method employed of growing the seedlings in flats. The reason for the great mortality in the use of thumb pots lies in the fact that it is extremely difficult to prevent the pots

Hybrid grapery from seed secured from plant breeding work in 1913. The seedlings are planted about one foot apart, in rows four feet apart, the intention being to fruit the vines for one or two seasons and then remove all but the promising hybrids.

from drying out. The method of raising the young seedlings now employed, and which gives every evidence of excellent results, is simply planting the seeds as soon as secured in the fall in cold frames in prepared soil, but without the use of either flats or thumb pots. A return to the use of flats was made in 1916, but in this case the flats were placed in cold frames, and the seed germinated there and is being held over in the flats until the spring of 1918. This method has given a germination of practically 60 per cent., which is good, but the difficulty now lies more in the transplanting than in the securing of a good germination. It is expected that planting direct in the frames without the use of flats will solve this difficulty.

The results of an experiment in the fall of 1915 to determine the best method of handling grape seeds point definitely to the fact that the seeds should be extracted from the pulp and then not allowed to become dry for any length of time before being planted. The outline of the experiment was given in the 1915 report, page 27. The result is given in the following table:—

TABLE XII.—RESULTS OF EXPERIMENT IN GERMINATION OF GRAPE SEEDS.

Variety	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5
	%	%	%	%	%
Lindley, Germination	0	81	87	7	10
Concord "	0	44	14	3	0
Massasoit "	0	74	24	13	1

Hybrid grapes growing in nursery rows. They will be transplanted to fruiting rows in the spring.

Hybridizing of 1916: Table XIII outlines the crossing work done with grapes for 1916. It will be noted that self-fertile varieties have been used as the female parent which means, of course, that it was necessary to emasculate before pollinating.

Table XIII.—Summary of Grape Crossing, 1916.

Cross	No. Seeds planted	No. Seeds Germinated	Per cent. Germination
Campbell x Delaware	242	170	70.2
Campbell x Read Hybrid	1,430	474	.....
Campbell x Winchell	990	525	53.02
Campbell x Diamond	385	243	63.3
Worden x Delaware	66	37	56.06
Worden x Read Hybrid	118	52	44.06
Worden x Winchell	88	47	60.09
Worden x Diamond	55	36	70.9
Niagara x Delaware	330	203	61.5
Niagara x Diamond	473	268	56.65
Niagara x Read Hybrid	1,320	852	64.5
Niagara x Winchell	1,078	700	64.9
Concord x Delaware	110	62	56.3
Concord x Diamond	112	46	41.07
Concord x Read Hybrid	139	73	52.5
Concord x Pierce	44	1	2.2
Pierce x Concord	24	7	29.1
Chasselas avec Royal x Concord	44	36	81.8
Chasselas avec Royal x Niagara	82	43	52.4
Iowa x Winchell	222	89	40.49
Total	7,352	3,964	53.91

Care must be taken another year not to start emasculating the blossoms too soon, as those emasculated before full maturity die before they are ready for pollination, especially if unfavorable weather intervenes. The Concord suffered the worst in this way in the 1916 work.

Self-Sterility Tests: Incidentally with grape breeding, self-sterility tests were made of many of the varieties in the variety test block. The fruit resulting from this work has been saved and the seeds will be grown to further supplement the above breeding work. The list below shows the grape seeds secured from the self-sterility tests in 1916, and which were planted that fall in cold frames.

Wilder x Campbell	1,155	Moore's Early selfed	660
Wilder x Niagara	990	Vergennes "	6,105
Wilder x Concord	990	Champion "	660
Wilder x Worden	1,618	Pierce "	207
Agawam x Worden	891	McPike "	495
Agawam x Niagara	572	Pocklington "	660
Agawam x Concord	825	Green Early "	1,142
Agawam x Campbell	1,155	Niagara "	445
Brighton x Concord	3,465	Pense Malaga "	1,155
Brighton x Worden	3,300	Campbell "	937
Brighton x Campbell	3,465	Lutie "	495
Salem x Concord	1,980	Read Hybrid "	589
Salem x Worden	1,980	Caco "	544
Salem x Campbell	1,980	Early Ohio "	165
Salem x Niagara	2,145	Winchell "	660
Herbert x Campbell	1,130	Delaware "	318
Herbert x Concord	1,320	Isabella "	291
Herbert x Worden	1,650	King "	165
Herbert x Niagara	1,485	Hartford "	319
Lindley x Campbell	317	Hicks "	330
		Lucile "	660
Total unemasculated crosses	32,413	Agawam "	487
		Diana "	330
		Total selfed seeds	17,819

With the result of the germinating experiment in mind, all these grape seeds were planted in flats as soon after they were extracted from the pulp as was convenient, buried two or three inches in flats in cold frames and given cold frame treatment in the spring of 1917. A germination of practically 60 per cent. has been secured, and the young seedlings are now being held in the cold frames ready to transplant in the spring of 1918.

Hybridizing of 1917: The work in 1917 consisted altogether of saving and planting the seed from the experiment in pollination of certain self-sterile varieties with self-fertile varieties. Salem, Wilder, Herbert, Lindley and Agawam were each crossed with Campbell, Concord, Niagara and Worden. Sixteen thousand and nine seeds were secured and have been planted in cold frames where they will germinate in the spring of 1918.

Blackberries.

The blackberry seed gathered from the 1915 crossing work (page 28, 1915 report) was planted shortly after being gathered, and was given various treatments in an effort to induce the seed to germinate. Up until the spring of 1917, however, very few seeds germinated, but that spring, after they had been planted a year and a half, they germinated in fairly large numbers. Those which germinated the first year are now in nursery rows in Section 1 from where they will be moved to permanent fruiting quarters in the spring of 1918.

With the kind permission of Messrs. David Troup, J. Hedden and Jerome Tufford, of Jordan, to work in their blackberry plantations, some of this work was repeated in 1916 and 1917. The following table summarizes the results of the two seasons' work:—

Table XIV.—Blackberry Crossing, 1916 and 1917.

Cross	No. Pollinations	No. of Fruits gathered	
Wilson x Early Blackberry (1916)...	221	107	
Wilson x Lucretia " "	247	112	
Wilson selfed "	180	108	
Wilson x Wachusett (1917)	242	147	
Wilson selfed "	176	77	Many more set but unfortunately were removed by pickers.
Agawam x Wilson "	120	83	
Agawam x Wachusett "	129	98	
Agawam selfed "	62	47	
Wachusett x Agawam "	400	21	The poor set in the Wachusett crosses
Wachusett x Wilson "	269	4	is due to the close conditions in the
Wachusett selfed "	170	41	tents caused by the large amount of
Loganberry " open poll..	200 approx.		foliage.
Wild Blackberry " " ..	.....	54	These were found growing at the edge of the bush adjoining the "farm." Plants very prolific with cylindrical compact berries with small druplets.
Wild Dewberry " " ..	.....	56	To all appearances these are the same as the blackberry, only of a trailing nature and root at the tip readily, two characters of the dewberry. The fruit is large, good quality, conical in shape with large shiny druplets, very early.

This blackberry here called Early Blackberry in the 1916 work, for want of a better name, is growing on Mr. J. Hedden's farm at Jordan. The original plants came from Pennsylvania about twenty-five years ago. It is early, of good quality, ripens all its fruit in two or three pickings and is as rust free as the Wilson, though not quite so hardy. The variety is probably Agawam.

In addition to the above, the following quantities of blackberry seed were planted in 1916 from which to grow seedlings:—

Early Blackberry	3 flats.	Kittatinny	4 flats.
Wilson	4 "	Taylor and Wachusett (mixed).	4 "

In this connection also might be mentioned one flat of loganberry seeds planted for the same purpose.

In the spring of 1917 a blackberry plantation was added to the Station and in future we hope to be able to do all such work at home and thereby save much time otherwise spent in going to and from the different plantations. No work on dewberries was done because there are no plantations in the neighborhood. Several varieties have been planted with the blackberries in Section 1.

Owing to the difficulty experienced in securing a good germination from blackberry seed experiments were outlined as follows to ascertain the best way of handling this seed.

Three varieties Early Black (Agawam), Wilson and Kittatinny were used in all cases.

Experiment No. 1.—Seed planted immediately upon ripening, with fruit detached and attached, in sterilized and in ordinary soil. Twelve lots in all.

Experiment No. 2.—Seed treated as in No. 1 but buried about six inches deep to remain there all winter and to receive cold frame treatment in the spring. Twelve lots in all.

Experiment No. 3.—Seed treated as in No. 1, buried as in No. 2, but to be lifted and given greenhouse care in February. Six lots in all.

Experiment No. 4.—Seed dried for one month in sand and then given growing conditions right away. Six lots in all.

Experiment No. 5.—Seed dried as in No. 4, but buried six inches deep and left until spring when they should receive cold frame treatment. Six lots in all.

Experiment No. 6.—Seed dried in No. 4, planted as in No. 5, but to be lifted and given greenhouse treatment in February. Six lots in all.

But, like all other slow germinating seed treated in pots the results were mostly negative, 10 per cent. being the highest germination obtained. The reason for this is: the pots are set and the constant watering with poor drainage, which is usual in small pots, allows moss and other foreign matter to start long before the seeds, with the results that none of the seedlings can get through. If any attempt is made to remove the moss the germinating seeds are disturbed and as in the other case the results are negative.

Pots for germinating all such seed have been discarded and we now simply use cold frames covered with sash. As soon as the berries ripen they are mashed in sand and when all are picked they are planted into good soil in the cold frames. A mulch of leaves is then put over this to prevent drying out and to keep down weeds. By winter this mulch is beaten down sufficiently so that the action of the frost is not retarded, but at the same time it prevents sudden thawing and freezing from taking place.

In the spring when the days begin to get warm these leaves are removed and sash takes their place. Care must be taken as to ventilation, etc., at this time

as the nights are still cold and extra heating during the day would be disastrous. The young plants are then left in these frames until the spring following germination when they are removed to the field.

The use of flats for such work in cold frames has been discarded also. They are very handy, should any moving be necessary, but during the summer in hot weather constant watering is necessary to keep them from drying out. Another big disadvantage is, that the roots become too matted to separate without destroying many at planting time, also a great many roots grow through the drain holes in the flats and cracks in the bottom of the flat and are consequently destroyed when the flat is moved. Then, too, the soil in a flat is shallow and limited in amount which starves and dwarfs the seedlings very materially.

Currants and Gooseberries.

With the exception of the germination secured from seed planted, results of the 1915 hybridizing work on currants and gooseberries were included in a table in the 1915 report of the Station, page 28. All of the seed secured failed to germinate with the exception of Pearl, Whitesmith and Broom Girl gooseberries, self-fertilized; and in currants: Eclipse and Fay's Prolific selfed.

Similar work was carried on in 1916 and 1917 with results as tabulated in the following tables:

Table XV A.—Currant and Gooseberry Breeding, 1916.

Cross	No. Poll.	No. Fruits Gathered	Remarks
Broom Girl x Pearl	545	320	
Wyndham's Industry x Pearl	78	33	
Ironmonger x Pearl	75	38	
Pearl x Broom Girl	.....	.....	Plant in the field. Was unable to complete owing to adverse weather conditions and considerable work done on it was lost.
Rubus Cynosbati x Broom Girl	142	42	
Black Champion Currant selfed	.....	622	
Black Champion Currant x Broom Girl (Eng. Gooseberry)	1,358	888	Seeds smaller than normal currant seeds.

The 1917 gooseberry crosses were made with the hopes of getting hardiness, quality and thornlessness, the *Ribes cynosbati* being used for the latter purpose.

Attempts were made to cross the currant and gooseberry, but owing to the gooseberry blooming a week ahead of the black currant the pollen lost its vitality and no fruit set. In future, the varieties required will be brought in the fall into the greenhouse where it will be possible to control the blossoming period.

Table XV B.—Gooseberry Breeding, 1917.

Cross	No. Pollinations	No. Fruit Set	No. Fruit Gathered
Industry x Broom Girl	115	71	71
Broom Girl x Industry	202	114	114
Broom Girl x Keen's Seedling	.....	73	73
Ribes cynosbati x Broom Girl	10	7	7
Ribes cynosbati x Industry	17	10	7
Keen's Seedling x Broom Girl	39	0	0
Broom Girl x Ironmonger	72	55	35
Industry x Ironmonger	31	10	10
Ironmonger x Broom Girl	46	9	9

Seedlings.—Currant and gooseberry seedlings planted in 1915 were held over in flats and were transplanted to the field in May, 1916. The list of the number transplanted was included in the 1915 report. There have been few casualties since transplanting.

The currant seed saved in 1915 germinated remarkably well and a large number were transplanted to the field. Gooseberries, however, germinated very poorly. Table XVI shows the number transplanted and the number growing in the field October, 1916. No later count has been made of the number now growing. The high percentage of loss here shown in the currants was due to the abnormally dry season. They were put out when the soil was moist and in good condition, and were watered, but large percentages succumbed later to drought.

TABLE XVI.—CURRANT AND GOOSEBERRY PLANTS GROWING, 1916, FROM SEED SAVED AND PLANTED IN 1915.

	No. Planted Out	No. Growing Oct. 1916
Currants:		
Fay's Seedlings	550	280
Red Cross Seedlings	500	139
Victoria Seedlings	.....	1
Ruby Castle Seedlings	400	47
Diploma Seedlings	800	194
Perfection Seedlings	100	49
Pomona Seedlings	400	91
Prince Albert Seedlings	500	108
Lindley Market Seedlings	500	1
North Star Seedlings	450	108
Cherry Seedlings	.....	4
Versailles Seedlings	100	1
Eclipse Seedlings	600	72
Climax Seedlings	550	123
Collin's Prolific Seedlings	700	167
Boskoop Giant Seedlings	800	276
Saunders Seedlings	400	144
Black Champion Seedlings	500	276
White Grape Seedlings	200	66
White Imperial Seedlings	250	62
Gooseberries:		
Champagne White Seedlings	.....	144
Red Jacket Seedlings	.....	0
Keepsake Seedlings	.....	6
Houghton Seedlings	.....	146
Hedgehog Seedlings	.....	0
Josselyn Seedlings	.....	0
Downing Seedlings	.....	130
Industry Seedlings	.....	16
Pearl Seedlings	.....	54

A large number of gooseberry seeds were planted out in the fall of 1916. No currants were planted, however, as there were already a very large number of seedlings and hybrids growing. Following is a list of the gooseberry seed planted. The quantity sown in each flat is sufficient for the flat without being disturbed when lifted in the spring. There are three flats each of:

Keen's Seedling	Victoria	Crown Bob
Whitesmith	Downing	Pearl
Triumph	Broom Girl	Pitmaston Greengage
Industry	M. C. S.	Keepsake
Champagne White	Lancashire Lad	Hedgehog
Green Gascoigne	Ironmonger	Leader
Bright Venus	Red Jacket	Champagne Yellow (one
Houghton	Langley's Beauty	flat only)

These have been kept in the flats over the season of 1917 and will be transplanted to the field in the spring of 1918. A very large percentage of the seed germinated.

Elderberries.

A large number of elderberry seeds were gathered during 1916, four flats being planted. They were treated the same as other small seeds; planted shortly after gathering and buried one or two inches in the cold frame until the spring when they were raised to the surface and given cold frame treatment. A fair germination was secured.

Raspberries.

Raspberries of 1913 breeding that failed to fruit in 1915 were described in 1916. Thirty selections were made in 1915 and transferred to a small plantation to be grown for future test. Several more selections were made in 1916.

The plants from 1914 breeding were kept in the nursery row until May, 1916, when they were planted in a permanent plantation three feet apart each way.

Describing hybrid raspberries. Out of this block of three thousand individual plants raised from seed and fruited, four hundred have been retained as worthy of further trial.

These plants made a reasonable growth during 1916, and most of them fruited in 1917. Descriptions were made of those which fruited. Those considered worthy of further trial were retained, all others being removed. A list of the original plantation is given on page 31, 1915 report. Of the total of 5,070 hybrids and seedlings there shown, 452 have been retained. This includes quite a number which have not yet fruited and most of which will likely be discarded after fruiting.

In those saved are also eighteen plants of *Rubus occidentalis,* the wild black caps, as found growing in the woods. The seed was sown and treated with the rest of the Rubus species. Under the more favorable conditions in which the

plants grew much more vigor was noted. All fruited in 1917 and gave a very uniform lot of fruit, all of which was better than that of the parent. Of these, eighteen were saved for further trial. As it is a well known fact that the black caps do better after being planted a year or two we may find them equal to our cultivated varieties another year.

The Gregg seedlings, of which there were ninety-three plants, nearly all fruited, and gave a most uniform crop of fruit, all of which seemed to have more size although perhaps not the usual quality of Gregg. These were all saved to fruit again next year.

A prevalent idea to-day is that Gregg is simply the wild species brought into cultivation, and as they have come so true from seed and the wild ones are so much like Gregg one would be almost justified in this belief.

Of the plants from 1915 breeding all are growing in Section 1, and for the most part are a very thrifty lot. A few Cuthbert x Gregg fruited and these in every case were of the purple cane type. Another year all should fruit.

Raspberry crossing was continued in the season of 1916, several of the F_1 hybrids of the 1913 breeding work being used also. These are designated by numbers. Table XVII outlines the work:

TABLE XVII.—RASPBERRY BREEDING, 1916.

Cross	No. Poll	Fruits Gathered	Remarks
1077 x 1089	578	274	
1950 x 1929	265	112	
481 x Cuthbert	243	227	
Gregg x Cuthbert	614	45	
Cuthbert x Gregg	435	.....	
Gregg selfed	12 sacks	61	Each sack covered a spike.

The breeding work in 1917 consisted chiefly of selfing of several of the selections from 1913 breeding partly to see how they break up. Several yellow fruited plants were selfed for the same reason.

TABLE XVIII.—RASPBERRY BREEDING, 1917.

No. of Hybrid	Parents	No. Pollinations	No. Set	No. Gathered	Remarks
1812	Herbert x Cuthbert	75	57	30	All under the bags
1866	Herbert x Cuthbert	50	.....	.....	set poorly showing a
1885	Herbert x Cuthbert	74	22	22	partial self-sterility,
1892	Herbert x Cuthbert	125	58	30	to, in some cases com-
2702	Cuthbert x Herbert	59	27	27	plete self-sterility, i.e.,
2807	Cuthbert x Herbert	64	24	24	1866 and 2501.
421	(Yellow) Marlboro x Herbert	76	30	30	All outside set fairly
1002	(Yellow) Marlboro x Cuthbert	96	50	50	well considering the
1067	Marlboro x Cuthbert	64	22	22	weather conditions,
2501	Cuthbert x Marlboro	74	.....	.....	etc., at the blooming
	Cuthbert x Herbert	150	141	141	period.

STRAWBERRIES.

Seedlings: The seedlings Nos. 37 and 40 as reported on previously are now being tested out in the commercial block, but as yet their value has not been ascertained.

Hybrids: The strawberries of 1913 breeding did not all fruit in 1915. The plantation was retained and those not recorded before were described in 1916. The only further selections made were twenty-eight selected especially for earliness. All the plants that did not fruit the first year were found to be inferior. The plantation of those selected last year were transplanted to Section 3 where each individual is represented by a matted row of about 50 ft., and where it was intended they should be compared for yield, quality, etc., against the commercial varieties. The site and soil have proven very unsuitable, however, many of the selections in the particularly low spots being almost completely killed out. A new plantation will be made in 1918 on the new Station property.

The plantation of strawberries of 1914 breeding located on Section 3 is still retained in the individual hills. A large percentage of these plants did not bloom during 1916 and owing to this fact records were not taken that year.

The plants secured from 1915 breeding were transplanted to the field in Section 3 in May, 1916. Table XIX gives the particulars of the number transplanted and the number now living. The first part of the table in which each plant is designated by number represents plants secured from previous hybridizing work which have been self-fertilized. The latter part of the table represents further variety crosses made.

TABLE XIX.—STRAWBERRY PLANTS SECURED FROM 1915 BREEDING.

Name	No. Transplanted	No. Now Living	Name	No. Transplanted	No. Now Living
20 selfed	14	14	573	9	8
21	13	9	574	23	21
22	7	2	576	13	12
23	17	13	577	17	17
24	25	25	578	20	19
26	18	17	586	9	9
27	8	7	587	3	2
28	16	16	588	9	8
30	13	7	1214	3	2
32	9	9	1220	5	3
33	14	11	5820	6	5
34	24	23	5821	6	2
35	17	16	5825	9	8
Number unknown	2	2	5826	2	2
36	14	12	5828	25	25
37	12	12	5832	2	2
38	15	13	5834	14	12
39	25	24	5810	5	5
40	33	30	5811	10	10
41	7	7	5812	8	8
189	15	12	5813	7	6
559	16	15	5814	8	3
560	71	66	5815	27	22
561	23	21	5816	20	19
562	42	41	5817	2	1
563	21	19	5818	17	17
564	25	23	Williams x Brandywine	669	595
565	20	17	Williams x Parson's	12	12
566	12	8	Williams x Sulphur	9	9
567	9	9	Williams x Joe	196	188
569	9	8	Williams selfed	196	171
571	51	47	Joe x Williams	466	440

Owing to the absence of the Hybridist on military duty during the early part of 1916, very little hybridizing work was done with strawberries that year. A number of plants of Williams, Joe, and Brandywine were self-fertilized, but owing

to the persistent wet weather of June the fruit which was protected by a muslin covered box, moulded instead of ripening properly. Seed was gathered and planted, but to date none has grown, and it is not likely that any will since strawberry seed usually germinates immediately.

The breeding for 1917 was carried on largely with the best of the selections from the 1913 breeding, crossing several of them with standard varieties as shown in the following table:

TABLE XX.—STRAWBERRY BREEDING, 1917.

Cross	Parents of Hybrids Crossed	No. Pollinations	No. Fruit Set	No. Fruit Gathered
2208 x	Williams x E. Ozark	78	50	17
1563	Dunlap x E. Ozark			
1563 x Joe	Dunlap x E. Ozark	79	61	27
2093 x	Williams x E. Ozark			
2209	Williams x E. Ozark	95	73	27
482 x Williams	Williams x Brandywine	68	14	2
Williams x 482	Williams x Brandywine	131	45	3
812 x Brandywine	Brandywine x Williams	27	10	3
1344 x Dunlap	Dunlap x E. Ozark	59	30	9
1467 x E. Ozark	Dunlap x E. Ozark	63	14	3
1744 x Joe	Dunlap x Williams	105	80	44
2594 x Williams	Williams x Dunlap	88	32	18
2641 selfed	Ozark x Williams			3
3688 x Brandywine	Bubach x Brandywine	65	47	20
3390 x E. Ozark	Bubach x E. Ozark	99	10	9
4496 x Dunlap	Sample x Dunlap	68	33	7
5715 x	Joe x St. L. Prize	91	74	55
419	Williams x Brandywine			
4496 x E. Ozark	Sample x Dunlap	168	28	25
2209 x	Williams x E. Ozark	41	25	9
2093	Williams x E. Ozark			
Brandywine x Williams		24	9	3

The low percentage of fruit set in some cases is partly due to a lack of pollen. For a long time after the work was begun it was difficult in many cases to obtain pollen partly from a lack of flowers, but mostly because the anthers refused to shed any pollen. Brandywine for a long time although having an abundance of flowers had very few anthers and these dried up instead of shedding their pollen. Early Ozark also at first bore very few anthers, but later these conditions improved in all and with it a marked increase in the setting of the fruit was noticed.

The unsettled weather at the time of pollination also hindered a good set as we were not able to pollinate the flowers as often as we should have. Emasculating, however, was done regularly.

The difference between the number set and the number gathered is due to damping off caused by the excessive rain during the fruiting season.

As soon as the fruit ripened it was mashed up in sand and when all was gathered the seeds were planted in cold frames where we have a very good germination of healthy plants.

Owing to the very unsatisfactory weather conditions experienced during the strawberry fruiting season of 1917 it was impossible to do any descriptive work at all on any of the breeding plots. The best commercial berries tasted poor, so that nothing of the quality of the fruit in the blocks of 1914 and 1915 breeding could be ascertained. It was decided to leave that work until 1918, but as the plants were getting old, and, as previously stated, the site was unsuitable, runners were

very carefully selected from each plant and moved under the irrigation to develop further roots. From here they will be transferred to the new property which is much more favorable for strawberry growing.

Tomatoes.

Yield of Cross-Bred vs. Open-Fertilized Seed: An experiment in the comparison of yields of cross-bred tomato plants with plants obtained from open-fertilized seeds, is under way. Results for one season were reported on in 1915. Further crosses were made in 1915 to carry on the work for another year, but unfortunately, the plants in 1916 were put on a very heavy soil so that it was finally deemed unwise to attempt to make comparisons of yields. However, the same crosses were made again in 1916 and seeds obtained to carry on the work during 1917.

As will be noticed in all cases the yields are very low, but as the season was very late the first picking was not until Sept. 9th. The yield per acre is based on the yield of fruit which ripened, not on the whole, as the green fruit is waste.

The plants were set 4 ft. x 4 ft. or approximately 2,700 plants per acre. The results were as follows:

Table XXI.—Yield of Cross-Bred vs. Open-Fertilized Seed.

Cross	No. Plants in plot	Total good fruit in lbs.	Green fruit in lbs.	Total yield	Yield per acre in bus.	Ave. for F_1
Royal Red x open pollinated	28	72.5	68.5	141	116.1	
Royal Red selfed	22	19.5	32.25	51.7	39.86	
Royal Red x Livingstone Stone	26	50.7	180	230.7	87.75	
Royal Red x Chalk Jewel	24	20.25	59	79.2	27.80	143.2
Royal Red x Earliana	24	167.75	92.5	260.2	314.1	
Chalk Jewel open pollinated	23	107	58.75	165.7	209.25	
Chalk Jewel selfed	25	125.75	125	250.7	226.35	
Chalk Jewel x Ponderosa	22	117.25	87.5	204.7	239.4	
Chalk Jewel x Earliana	26	324	27.75	351.7	576	
Chalk Jewel x Royal Red	25	89.25	121.25	210.5	160.65	327.02
Chalk Jewel x Livingstone Stone	26	185	89.25	273.2	319.83	
Chalk Jewel x Bruce's	24	181.25	88.5	269.7	339.25	
Livingstone Stone open pollinated	22	63.25	92.25	155.5	129.15	
Livingstone Stone selfed	24	119	56	175	222.75	
Livingstone Stone x Bruce's	25	161	58.25	219.5	289.66	
Livingstone Stone x Earliana	24	206.75	28.25	234	387.45	
Livingstone Stone x Royal Red	26	62.5	182.25	244.7	108	265.74
Livingstone Stone x Ponderosa	27	135	210	345	225	
Livingstone Stone x Chalk Jewel	20	141.75	28.5	170.2	318.6	
Bruce's open pollinated	25	80	41.75	121.7	144	
Bruce's x Chalk Jewel	6	48.75	15	63.7	365.4	
Bruce's x Earliana	23	172.75	16.25	189	337.95	
Bruce's x Royal Red	9	39.5	20	59.5	197.1	283.04
Bruce's x Livingstone Stone	23	181.5	93.25	211.7	231.7	
Ponderosa open pollinated	21	66.5	63	129.5	142.2	
Ponderosa selfed	18	75	64.5	139.5	187.2	
Ponderosa x Chalk Jewel	24	98.75	31.25	130	184.95	
Ponderosa x Bruce's	20	92	28.5	120.5	207	
Ponderosa x Royal Red	27	66.75	62.5	129.2	111.15	188.82
Ponderosa x Livingstone Stone	25	110	58.25	168.2	198	
Ponderosa x Earliana	22	119	29.25	148.2	243	
Earliana open pollinated	24	131.75	10	141.7	246.6	
Earliana x Livingstone Stone	24	182.75	12	194.7	342.45	
Earliana x Ponderosa	18	119.25	15.75	135	297.9	
Earliana x Chalk Jewel	22	125.75	12.5	138.2	256.9	330.03
Earliana x Bruce's	29	258	9.5	267.5	400.05	
Earliana x Royal Red	22	173.5	59.5	233	352.8	

Trying to secure a cucumber of the White Spine Type that will set fruit without fertilization.

Crossing Telegraph and Early White Spine Cucumbers.

Tomato x Solanum balbisii: During the past four seasons a considerable amount of work has been carried on in an attempt to cross tomato with *Solanum balbisii.* As many as eight or ten thousand plants were examined individually and carefully in 1916 for any evidence of these two plants being crossed, but none whatever was found. These plants were supposedly the third filial generation of the cross. We have found in this work that a small percentage of tomatoes will set fruit and develop to marketable size without fertilization, as they have been obtained without seeds in them. They may have been induced to develop by stimulation effected with the *Solanum balbisii* pollen. Other tomato fruits have developed with a few seeds only, and it is from these seeds that the plants have been grown for two or three generations. The development of these seeds shows clearly two things: either that some few tomato seeds are developed parthenogenetically or else they were due to tomato pollen being accidentally applied to the pistil during the crossing operations which seems the most liable to have occurred under our out-door methods. This work was re-started each year as well as the successive generations being carried along from the seeds obtained during the first year's work, but now the whole experiment has been discontinued.

Incidentally, while making observations on the plants used in the tomato x *Solanum balbisii* crossing work, a number of plants were found which produced fruit with a reduced number of seeds. Seed from each selected plant was grown separately and the fruit examined for reduction in seed numbers, but all were as well filled out in this respect as ordinary tomatoes.

Cucumbers.

The first crossing was done in 1915 with the object in view of securing a White Spine type of cucumber that will set its fruit without fertilization. The following number of plants were secured from the crosses made that year:

Table XXII.—Cucumber Breeding, 1915

—	No. Seeds Sown	Germination
Telegraph x Early White Spine	31	19
Early White Spine x Telegraph	210	176
Fordhook Famous x Telegraph	112	106

There were a large number of undeveloped seeds which were also sown but none germinated.

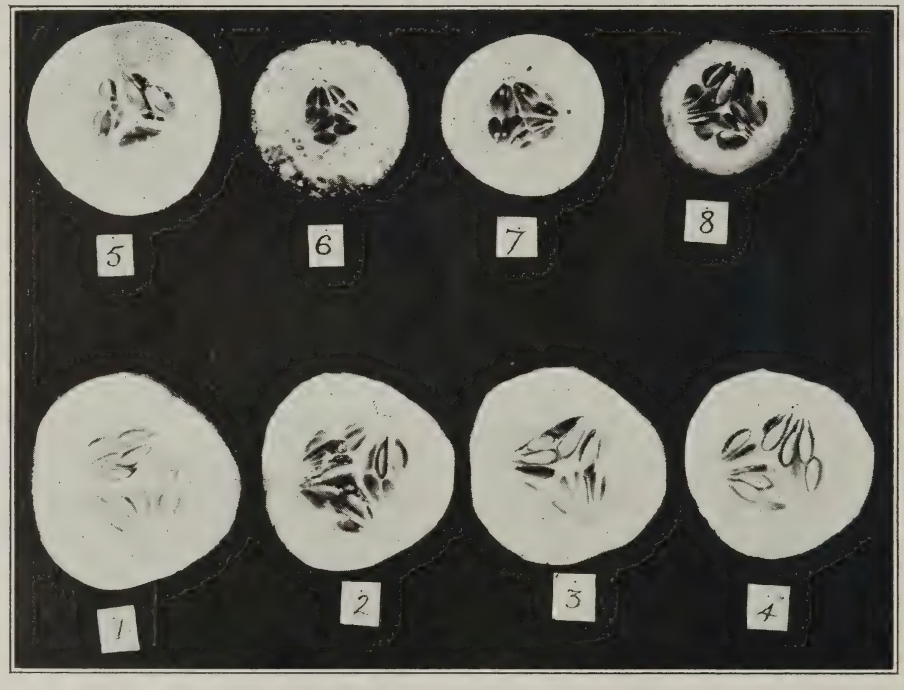
Four of these plants were selected at random and grown in the greenhouse; the remainder were transplanted to the field. Ten flowers on each plant were covered with a paper sack to test the plant's ability to set fruit without fertilization. Most of the plants set no fruit at all from these flowers, but a few set one and some two. That means a few set 20 per cent. of their fruits without fertilization; but it was later proven that the pure White Spine varieties would also set a similar percentage without fertilization.

All of these plants were of intermediate type between the two varieties crossed with one exception, which was a dwarf plant. The plant appeared the same as all the others with the exception that the internodes were very short. An attempt was made to self-fertilize one or two of its blossoms, but failed. The same plant matured three fruits, open fertilized, but they contained no viable seeds.

The illustration on page 38 shows the parents, one on either end, and fruits selected at random from the F_1 plants. A description of the illustration is here given:

1. Early White Spine.
2. F_1 Telegraph x Early White Spine, grown in greenhouse.
3. F_1 Early White Spine x Telegraph, grown in greenhouse.
4. F_1 Early White Spine x Telegraph, grown outside.
5. F_1 Telegraph x Early White Spine, grown outside.
6. F_1 Telegraph x Early White Spine, set parthenogenetically.
7. F_1 Early White Spine x Telegraph, set parthenogenetically.
8. Telegraph.

It will be noted here that the F_1 fruits are all intermediate in type and it may be further noted that the two fruits which were developed parthenogenetically are not so highly developed laterally as the others were which later contained matured seeds.



Crossing White Spine and Telegraph Cucumbers.

Above is a photograph of the same eight fruits in cross section and the description is the same as for the previous illustration. It will be noted here also that these fruits are all intermediate in type. The two fruits that set parthenogenetically, have a seed cavity with no seeds, while the others have many seeds and as large a seed cavity as the Early White Spine itself.

The plants within the greenhouse were given the same treatment as those in the field, that is: ten flowers on each plant were covered to set fruit parthenogenetically, but none set. Five flowers on each plant were also self-fertilized with the result that considerable seed was secured for growing the F_2 generation.

During 1917 the F_2 generation of these crosses was grown, but the results were a decided disappointment owing to climatic conditions. The young plants at

the start had a hard struggle against the rains and were kept very late. As soon as possible bags were put over the female flowers to see if they would set without pollination. We hoped to get ten sacks on each plant, but as we neglected to do any pruning of the vines the supply of flowers became exhausted. Before more had developed a severe attack of Cucurbit wilt cleaned off the most of the patch. We next turned our attention, not to getting parthenogenetic results, but to self some of the most promising ones for seed. Several days were spent in this work but no fruit resulted. Open pollinated fruit, however, from some of the best plants left was secured and the seeds taken for another year, which we hope will be more favorable.

Solanum Nigrum.

Solanum nigrum—Stubbleberry or Black Nightshade: Fruit black, globular and about the size of a sour cherry (when grown under cultivation).

This plant is found growing wild on newly broken land in Ontario and in the stubble fields of the North-West, from where it gets its name of "stubbleberry." The plant is an annual and the seeds may be started within the greenhouse the same as tomatoes and transplanted out later or may be planted directly in the field in the spring. The fruit ripens in August and September and does not shell off the plant when ripe but will hang on in a ripened condition for a long time.

Stubble Berry.

The fruit may be used in the fresh state for pie making, etc., or may be made into preserves. It is not poisonous although the botanies make a note that it is said to be poisonous.

Plant Immigrants.

The Bureau of Plant Industry, Washington, D.C., issues a monthly list of all plant immigrants to the United States, and through the courtesy of that Department we have received a number of plants and seeds. Application is made at the time the monthly list comes to hand and we receive the plants and seeds requested as they become available for distribution.

Following is a brief and summary report of all plants and seeds received to date with the exception of grapes which are reported separately:

5	plants	34515	*Amygdalus davidiana* received April 14th, 1914. All succumbed to transplanting.
2	"	35891	*Castanea sp.* received April 14th, 1914. All succumbed to transplanting.
5	"	35093	*Buddleia invea* received April 14th, 1914. Four succumbed to transplanting. One grew and afterwards died.
225	"	36664	*Amygdalus davidiana* received April 3rd, 1915. They make good and rapid growth and would indicate being good stocks for some kind of work. Most of these have been destroyed but a few are retained to fruit and for budding purposes. Grows well on either heavy or light soil.
1	"	34684	*Amygdalus persica nectarina* received February 16th, 1915. Succumbed to transplanting.
1	"	35288	*Corylus mandshurica* received February 16th, 1915. Plant is small and slow and poor in growth.
1	"	21989	*Amygdalus persica* received April 3rd, 1915. Strong, vigorous grower. To all appearances, the same as our ordinary peaches.
1	"	24915	*Amygdalus persica* received April 3rd, 1915. Two plants succumbed to transplanting and the other is small and has made very little growth.
3	"	36666	*Castanea mollissima* received April 3rd, 1915. Two plants succumbed to transplanting and the other is small and has made very little growth.
1	"	37006	*Prunus armeniaca* received April 3rd, 1915. Plant is small and has made very little growth.
1	"	36111	*Prunus tomentosa* received April 3rd, 1915. Making good, vigorous growth.
2	"	36086	*Prunus tomentosa* received April 3rd, 1915. Making good, vigorous growth.
2	"	36271	*Solanum aculeatissium* received April 3rd, 1915. Did not fruit in 1915 and succumbed to frost in the fall.
2	"	36934	*Cyphomandra betacea* received April 3rd, 1915. Did not fruit with us.
1	"	40904	*Rubus canadensis* received November, 1915. Succumbed to transplanting.
1	"	37463	*Prunus cerisifera divaracata* received April, 1916. Succumbed to transplanting.
1	"	37559	*Amygdalus pendunculata* received April, 1915. Succumbed to transplanting.
1	"	32670	*Prunus spinosa* x *domestica* received April, 1916. Succumbed to transplanting.
2	"	34601	*Prunus mira* received April, 1916. Succumbed to transplanting.
1	"	22471	*Corylus avellana* received April, 1916. Just held its own against an adverse season.
1	"	36662	*Juglans regia sinensis* received April, 1916. Just held its own against an adverse season.
1	"	26250	*Prunus conradinae* received April, 1916. Just held its own against an adverse season.
1	"	22468	*Corylus avellana* received April, 1916. Just held its own against an adverse season.
1	"	21982	*Pyrus betulaefolia* received April, 1916. Succumbed to transplanting.

1 Plants 28489 *Malus baccata* x *sylvestris* received April, 1917.
1 " 43443 *Pyrus chinensis* x *communis* received April, 1917.
1 " 40698 *Euonymus nanus* received April, 1917.
2 " 40581 *Euonymus radicans acutus* received April, 1917.
2 " 40595 *Rubus irenaeus* received April, 1917.
Seed 39724 *Brassica pekinensis*, Chinese lettuce, received January, 1916.

This lettuce which is really a cruciferæ resembles the ordinary lettuce in habit and growth. The seed was started early inside and transplanted sometime early in June. Considerable growth was made and no heads of any account were formed. The tender leaves were very desirable as early green vegetable, quality being very good. Seed stocks were produced almost immediately and a large quantity of seed was produced. A small quantity of this seed was started later in the season and then transplanted outside for fall growth.

Seed 27,988 Cucumis melo .....
28,965 " " .....
29,237 " " .....
30,471 " " .....
} Melons received January, 1916.

These melons did not grow very well, two melons being all that matured, and these were of small size and of only medium quality. A number of seeds have been saved for trial the following season.

Seed 41056 *Alium capa* (Onion), received January, 1916.

A part of this seed was sown in the greenhouse and transplanted out early in the season and produced good size average bulbs, but there was a great variety of colors and shapes from this seed. Another part of the seed was sown later in the season out-doors and produced all thick necks and no bulbs. Some of this seed was saved for trial in 1917.

POMOLOGY.

Apples.

The work with apples in Sections 2 and 5 has been limited to the identification of the varieties and the taking of notes on blooming dates, amount of bloom, date of ripening fruit, date of picking and the yield of each tree of the different varieties under test. Some replanting has been found necessary and nursery stock was ordered to fill these vacancies in the spring of 1917. A considerable number of new varieties are also being added.

Lime-Sulphur vs. Soluble Sulphur for Scab Control: This experiment was continued as outlined in the 1915 report. In addition, an attempt was made to measure the amount of foliage injury from the two sprays. In 1915, the injury was not severe enough to be measured though the trees sprayed with lime-sulphur had a more thrifty appearance due to the color of the leaves. In 1916, however, the spray injury to the leaves from soluble sulphur was 32.76 per cent. and from the lime sulphur, 11.76 per cent. This, of course, does not represent the amount of leaf *surface* injured by the spray, but is simply a comparison of the leaves in any way injured by the spray. In most cases this would amount only to a slight burning. The percentages were arrived at by making four separate observations, the total number of leaves on four representative branches on different sides of each tree being determined. The number injured by spray was counted separately and the percentage determined from an average of these four observations.

Thinning Experiment: The experiment in thinning, as outlined in the 1915 report, was again carried on in 1916, but has since been discontinued. As in 1915, the 1916 crop was only medium in quantity and, therefore, little difference could be observed between the thinned and unthinned trees. In 1917 there was no fruit whatever. A thinning experiment is a very difficult experiment to handle since to show marked results from thinning the trees must be so heavily loaded that they are incapable of maturing their fruit to a good marketable size. Suppose we have two trees each capable of bearing at its best ten barrels of apples, and each of which sets only sufficient fruit to bear that quantity. If we thin one-third of the fruit off one tree and none off the other, the final result in weight of fruit would be the same, as the fruit on the thinned tree would simply grow larger than on the unthinned tree, but would not bulk up any more than the maximum load—ten barrels of apples. Of course the thinned apples will be of somewhat better size and color due to their being spaced, but apart from that the experiment would prove of little value (since both thinned and unthinned trees have produced the same quantity of marketable fruit) *unless* some effect on future crops could be observed on the thinned trees. As to the value of thinning overloaded trees there is little doubt, but the difficulty in experimental work is to secure trees that will overbear fairly regularly—not once in four or five years.

Cultivation and Pruning Experiment: This experiment was outlined fully in the 1915 report. So far, notes taken have been limited to:

1. The diameter of the trees.
2. The blooming dates.
3. The number of blossom clusters.
4. The date of first fruit.
5. The number and weight of fruit harvested.

In addition to these points it is planned to make the following observations in future seasons:

1. Length of annual twig growth.
2. Size of leaves.
3. Color of fruit.
4. Blemishes of fruit.
5. Keeping quality of fruit.

While to take these notes on every tree in the experiment may be too big an undertaking, it will be possible to make them for one or two varieties right across the six cultivation blocks. This should give ample evidence on which to draw conclusions.

In 1916 photographs of trees in the different blocks were taken to show any differences in vigor. These are on file in the office of the Experiment Station.

At present, since results are more apparent, the pruning experiment is attracting more attention than that on the different cultural methods. A complete outline of this experiment is given in the 1915 report, page 44. A summary of the number of blossom clusters and trees under test conveys clearly the present comparative value of the different methods of pruning for fruit production. Attention is called to the fact, however, that the winter pruning has been more severe

Row of winter pruned trees on left, summer pruned trees on right.

than is usually practiced, the aim having been to provide a strong framework for future crops without regard for early bearing. If possible, a pruning experiment which will include light and medium dormant pruning is to be started shortly.

TABLE XXIII.—AVERAGE NUMBER OF BLOSSOM CLUSTERS PER TREE FOR THE YEAR 1916.

Variety	Unpruned		Winter Pruned		Summer Pruned	
	No. of Trees	Ave. No. per Tree	No. of Trees	Ave. No. per Tree	No. of Trees	Ave. No. per Tree
Hyslop	12	434.25	12	7.75	10	290.3
McIntosh	6	4.16	6	0	5	1.4
Jonathan	6	506.5	6	16	5	331.6
Cranberry	6	32.66	6	0	5	100.2
Hubbardston	6	276.0	6	1.16	5	139.8
King	6	62.16	6	0	5	13.4
Baldwin	6	52.5	6	0	5	11.5
Greening	6	152.16	6	1.5	5	112.6
Spy	6	0.33	6	0	5	0
Ontario	32	80.906	36	8.88	34	30.68
Wealthy	32	131.31	36	5.22	34	102.205
Wagener	32	264.31	36	4	34	138.94
Duchess	32	189.5	36	3.61	34	59.38
Dudley	21	593.04	24	3.54	23	266.304

Table XXIV is a summary of the weight and count of fruit from the different systems of pruning and also from each block in the cultivation experiment:

TABLE XXIV.—SUMMARY OF FRUIT PRODUCED IN 1916 ON TREES IN,

—	No. of Trees	Total Wgt. of Fruit	Total No. of Fruits	Ave. Wgt. of Individual Fruits
A.—Pruning Expt.				
Unpruned	207	3260.2	14,416	.2261 lbs.
Winter Pruned	228	226.95	781	.2905 lbs.
Summer Pruned	209	1819.9	7,169	.2538 lbs.
B.—Cultivation Expt.				
Summer Fallow	95	660.95	2,910	.2267 lbs.
Cover Crop in June	114	947.95	4,232	.2239 lbs.
Cover Crop in July	114	882.30	3,513	.2511 lbs.
Four year Rotation	113	1328.6	5,528	.2403 lbs.
Four year Rotation plus manure	113	1399.2	5,896	.2374 lbs.
Sod Mulch	95	89.6	287	.3121 lbs.

NOTE.—In 1917, the crop was practically a total failure, hence it is not included in the above tables.

Row of summer pruned trees on left, unpruned trees on right.

The summary as regards the average weight of individual fruits does not accurately represent the results, since practically no Hyslop crabs were produced on Block 6, thus making the average size of the apples from this block larger than those from the other blocks. When results from future seasons' work are available, tables will be worked out separately for each variety in the experiment.

As will be readily seen from a careful study of Tables XXIII and XXIV the results to date are very uniform throughout. The early bearing varieties of the summer pruned and unpruned trees were loaded with fine, marketable fruit both in 1915 and 1916, while the winter pruned trees, with one or two exceptions, have borne practically no fruit. (As previously noted no attention was given to early bearing in the winter pruned trees.) In 1915 the winter pruned trees bore no

fruit, the summer pruned trees 127.7 lbs., and the unpruned trees, 209.4 lbs. There appears to be no doubt that summer pruning will bring the young orchard into profitable bearing much quicker than the plan usually recommended of heading back severely each year. The unpruned trees, of course, have given similar results, but due to lack of pruning the trees are not in as good condition for future bearing. They are more straggly and have too many branches which criss-cross through the tree, thus not allowing of as free a circulation of air or as much sunlight as is desirable for the control of insect pests and diseases, and the production of the best quality of fruit. Experimental work at the Woburn Experimental Fruit Farm, England, and at various stations in the United States has demonstrated, however, that *light* dormant pruning will probably allow apple trees to bear as early and heavily as summer pruning or no pruning. In our own experiment it is natural to suppose that when the winter pruned trees have been trained to the desired framework, and the annual pruning gradually reduced, this method of pruning will show up relatively better than it has done thus far.

Six-year-old Greening, summer pruned.

Six-year-old Greening, unpruned.

Table XXV.—Per cent. Increase in Diameter of Trunk from 1914 to 1917.

——	Winter Pruned	Summer Pruned	Unpruned
Hyslop	91.61	95.44	102.22
McIntosh	124.85	128.16	157.53
Jonathan	87.92	119.82	135.11
Cranberry	86.68	95.63	106.75
Hubbardston	92.36	101.42	108
King	100.79	137.7	111.75
Baldwin	114.75	118.74	123.66
R. I. Greening	101.84	142.71	139.68
Spy	86.46	102.53	105.71
Ontario	97.05	123.27	132.64
Wealthy	100.45	121.64	125.87
Wagener	98.16	110.84	109.94
Duchess	95.79	136.85	119.02
Dudley	103.22	109.54	118.76

A study of the figures in the above table shows that without exception the summer pruned and unpruned trees have outgrown the winter pruned trees. Between the summer pruned and unpruned trees the difference is not so marked, the difference generally being in favor of the unpruned trees. The difference in the average diameters of the trunks in the three systems of pruning is, of course, correlated with differences in the general size and vigor of the tree. The inference is that though heavy dormant pruning of young trees may stimulate new growth yet this new growth does not equal the amount of wood cut off plus what new growth would naturally have been made. Hence the feeding surface of the tree is reduced and thus the general size of the tree, as indicated by the trunk diameter.

Cherries.

The work with cherries has been limited to the identification of the varieties and the usual records of blooming dates, amount of bloom, date of ripening, date of picking and the amount of fruit for each tree. As this block is strictly for variety study purposes the number of trees of any one variety has been reduced to three. Formerly there were up to twenty or more trees of some varieties, but as they were scattered throughout the orchard no experimental work could be outlined for them. The extra number were useless and they have therefore been removed and are being replaced with new varieties thought worthy of testing.

The soil of Section 6 is apparently an excellent, sandy loam, but past experience has shown that cherry trees do not thrive in it. The reason for this is not quite clear. It is planned to make a complete soil survey of the Section the coming season, 1918, if time is available.

Peaches.

Bloom and crop notes are on file. During 1917 peach blooming continued from May 18th to June 9th, while the fruiting season commenced with Mayflower, August 1st, and lasted until Smock were ripe, October 30th. From October 9th repeated frosts occurred which injured and in some cases badly froze such late varieties as Lemon Free, Late Elberta, Smock, Chair's Choice, etc.

An attempt has been made in 1917 to verify the identity of all varieties in the orchard so that we may have only those which, as far as can be ascertained, are true to name. A great many trees were found incorrectly named; the names of others were unknown but all except a few which did not fruit, new plantings, or those which it was thought wiser to leave for another season's evidence, have been either designated on the lists as true to name or if incorrectly named removed from the orchard. It is hoped that by the end of the season of 1918 only trees which have not fruited will remain unverified and these can easily be dealt with as they come into bearing. Many new varieties are being added from year to year.

At the south end of the peach variety orchard eight varieties of apricots and two of nectarines are being tested. The usual notes on the blooming dates, amount of bloom, date of first fruit, dates of picking and the amount of fruit taken at each picking have been recorded for each tree. In 1916 all the varieties ripening their fruit before September 25th were identified, and a few of the varieties described.

Plum Roots for Peaches: The outline of this experiment and the results up to and including 1915 were given in the 1915 report. The value of this experiment has always been considered rather doubtful since no records were kept

other than the yield of the individual trees. Also, in the spring of 1916 it was found necessary to remove six of the twenty-two rows of trees in the orchard to make room for grape seedlings. The remainder of the orchard was removed in the fall of 1916 to make room for hybrid and seedling peaches, apples and pears.

Ringing Experiment: It has often been observed that a branch of a peach tree partly ringed by canker will ripen its fruit earlier than a healthy, vigorous branch. This fact, along with the knowledge that the ringing of other tree fruits and of grape vines, will hasten the ripening of their fruit led to the following experiment being outlined for ringing peach trees:

Object: To ascertain the value of ringing branches of peach trees to hasten the ripening of their fruit; and also, the time at which this ringing may be most advantageously done.

Procedure: Only those branches to be removed in next year's pruning to be ringed. The ring to be about three-eighths of an inch wide. Five branches to be ringed at each of the following periods:—

1. Two weeks after date of blossoming.
2. Every two weeks until the second week in August.

Conclusions to be drawn from observations on the following points:

1. Date of ripening.
2. Color of fruit.
3. Size of fruit.
4. Susceptibility of fruit to disease.
5. Effect on vigor of the tree.

During the season of 1916 Brigdon trees were used and the experiment conducted as outlined, with the same result in each of the twenty-five branches ringed. The branches gradually lost vigor, the fruit developed little after ringing, and in most cases, gradually dried up. On not one of the twenty-five branches did a single peach mature. Those branches ringed earliest in the summer were dead by September 1st. This result is somewhat discouraging. Perhaps it was due to the fact that too small branches were chosen. Only branches measuring ½ in. to ¾ in. in diameter were used.

The experiment was carried on in 1917 as outlined in 1916, except that slightly larger branches, ¾ in. to 1½ in., were used instead of ½ in. to ¾ in. as in 1916.

From the standpoint of fruit produced alone the ringing of peach branches does not give satisfactory results. Many normal fruits could be had from the same trees ripening practically at the same time, and weighing .5 lbs. and over, much larger, that is, than the ringed fruit. Brown rot was much more prevalent on the fruit of the ringed branches than on normal fruit, and fully 50 per cent. of the former fruit did not develop at all. Most of the ringed branches had died or were dying at the time the fruit was mature, except those branches ringed so late that no effect on the fruit could be expected.

It hardly seems, therefore, judging from the data secured that the ringing of peach branches can offer any advantages, even as a special practice.

Pears.

Conditions during the seasons of 1916 and 1917 were not favorable for a large yield. Unfavorable weather during blossoming reduced the set of fruit to a much smaller per cent. than usual. Also in 1916 the latter part of the season was unfavorable for ripening the later varieties. Young trees did not mature their crop owing to the extremely dry period during ripening.

To check the pear blight the variety test block was seeded to sweet clover in 1915. This made a heavy growth during the early part of the summer of 1916 and was cut and mulched around the trees. In spite of this, however, the soil became very hard and dry. For 1917 it was planned to cultivate part of the space between the trees leaving each tree in about an eight-foot square of sod, but owing to the extremely wet spring it was impossible to cultivate at all.

To fill up the vacancies caused by pear blight in the past the plan has been adopted to fill such vacancies with dwarf stock unless standard is specifically called for, as in the first twelve rows. Dwarf Duchess and Bartlett were the two varieties selected for this purpose and these trees will be top-worked with the varieties desired for testing.

Spring and Fall Planting of Pears: An experiment in fall vs. spring planting in dynamited and dug holes was started in 1911. The Clapp's Favorite pear was used for this experiment, six trees being planted for each of the systems. The original plantings were made October 27th, 1911, and April 30th, 1912. Similar plantings were made in the fall of 1912 and spring of 1913, and fall of 1913 and spring of 1914. In the fall of 1914 and spring of 1915 Bartlett pears were used for similar tests. For the above experiment every attempt is made to get stock from the same nursery and budded or grafted at the same time.

The results generally are distinctly in favor of fall planting. It remains to be seen, however, whether the spring planted trees will overcome, in part or altogether, the lead that the fall planted trees now have.

Self-Fertility Test of Pear Varieties: In the spring of 1917 an experiment was started with the object of ascertaining the percentage of self-fertility of as many varieties of pears as were available. Twenty varieties were included in the 1917 work.

Twenty-five blossom clusters of each variety were covered with paper bags and the necks of the bags fastened with marking tags; another twenty-five clusters were marked with tags to keep track of them but otherwise exposed to normal conditions.

Owing to the adverse weather conditions prevailing throughout the blooming period the set on all varieties, with the exception of Seckel and Chinese Sand Pear, was very poor, in fact with the three varieties not one fruit set on the twenty-five tagged bloom clusters. With Kieffer the stamens matured a little before the pistil was receptive but there was plenty of pollen still available at that time. On all other varieties the anthers burst shortly after the blossoms opened; thus an abundance of pollen was available during the time the pistil was receptive, but no insects were present to work on the flowers. Because of the unusual conditions existing this season it will be necessary to substantiate the work done before any attempt at drawing conclusions can be made. Only two fruits were harvested, one Lawrence and one Tyson, both of which dropped before mature. Descriptions and photographs of the seed will be included in a later report on the work, when other results are available for comparison. Of the eighteen seeds in the two fruits only two were plump and sound.

Plums.

The usual notes on blooming dates, amount of bloom, date of ripening fruit, date of picking fruit and the yield were made during the seasons of 1916 and 1917, for each tree of the 130 varieties represented in the block. As with peaches an effort was made to identify as many as possible of the varieties in the orchard. Over 110 varieties were identified as either true to name or otherwise.

Fall vs. Spring Planting in Dynamited and Dug Holes: In the south end of the plum orchard, an experiment is being conducted on fall vs. spring planting of trees in dynamited and dug holes. The experiment was outlined in the annual report for 1915 in which report also some preliminary observations on the experiment were made. However, the experiment has not yet been conducted long enough to give conclusive evidence as to which is the better time or method of planting, though as with pears, present indications are strongly in favor of the fall planting. Complete records are being kept from year to year.

MISCELLANEOUS EXPERIMENTS.

Fall vs. Spring Plowing of Cover Crops: (Apple and Dwarf Duchess Pear Orchard.)

A block of apples containing one row each of eleven trees of the following varieties: Canada Red, Gravenstein, Blenheim, Stark, Fameuse, Duchess, Cayuga, Wolf River, St. Lawrence, Ribston and Astrachan, and interplanted with dwarf Duchess pears is being used for an experiment in fall and spring plowing.

Half of this section is fall plowed and half spring plowed, each half being treated the same year after year. Three cover crops are used: Rye and vetch, oats and clover, and buckwheat. The experiment, therefore, consists of six sections, or three cover crops fall plowed and the same three spring plowed. Study is made each season of the new growth, trunk growth, set of fruit and the crop that ripens in proportion to the blooming. The real questions are, a study of moisture in relation to cover crops, and the effect if any of spring plowing on the June drop.

Moisture determinations are taken three times during the season: First in the spring just before the cover crop is plowed under on the spring plowed block, again in July just previous to sowing the cover crop, and finally just before the fall plowed block is plowed under. The object of these tests is to determine the relative moisture content of the soil under three different cover crops being used, rye and vetch, buckwheat, and oats and clover, and under fall and spring plowing of these cover crops.

Record is also kept of the depth of freezing taken at different intervals during the winter for both plowed and unplowed blocks.

To date no data of value on this experiment is available. The sections are equally good. Of course the fall plowed sections freeze much deeper than the spring plowed. This is due to the greater snow-holding capacity of those blocks which still have a cover crop on them; that is, the blocks which will be plowed under in the spring. Rye and vetch, which made very little growth, froze to almost the same depth spring plowed as fall plowed. Very little difference is to be noted in the freezing depth from the various cover crops fall plowed.

Fall Planted Trees: In order to determine the differences, if any, between fall planted trees secured from nurseries at different altitudes, and dug at different dates, one and two-year-old apple, plum and pear trees were secured from different nurseries and set out in Section 7 in the fall of 1915. Unfortunately, no really suitable land was available for this experiment. On the plot chosen the soil is not uniform and the north-east part of the experiment is on low, heavy clay loam; the south half on a medium, light sandy loam soil. As a result of heavy rains early

in the season of 1916, water lay for a period of two weeks about the trees in the north half of the experiment. Because of these unsatisfactory conditions it is impossible to draw any definite conclusion.

Grapes.

The experiments conducted in the vineyard were, with one exception, continuations of those begun in 1915. Since these experiments were outlined and the method of procedure described in the annual report for 1915, it will simply be necessary here to present results for 1916.

Grape self fertility tests. Left to right, Salem, Agawam and Massassoit. The three upper bunches were self fertilized, the three lower bunches cross-fertilized.

Self-Fertility of Various Varieties: An experiment was started in the summer of 1915 to determine the average degree of self-fertility of the different varieties of grapes represented in the variety test block. The results as tabulated in Table XXVI give (1) the name of the variety tested, (2) the number of bunches of flowers covered just before they opened, with a half pound manila paper bag, (3) the average degree of self-fertility of the flowers on those bunches, (4) the conditions of the stamens whether upright or recessive. The table includes results for 1915, 1916 and 1917, and the average for the three years. The average may be taken as fairly conclusive.

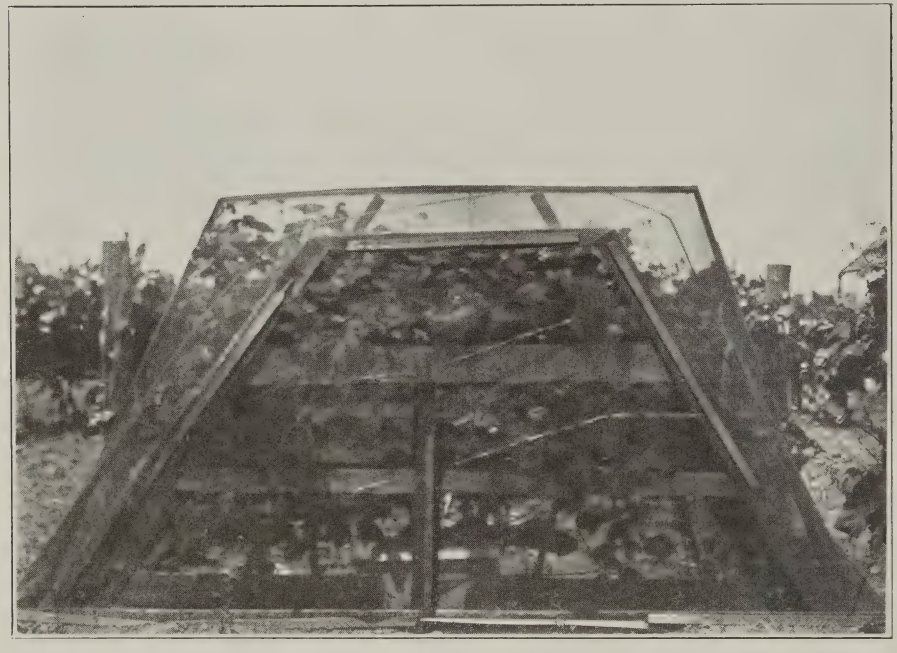
TABLE XXVI.—DEGREE OF SELF-FERTILITY OF VARIOUS VARIETIES OF GRAPES.

Variety	1915		1916		1917		Average	
	No. of Bunches	Ave. % Self-Fertility	No. of Bunches	Ave. % Self-Fertility	No. of Bunches	Ave. % Self-Fertility	Condition of Stamens	Ave. % Self-Fertility in 3 yrs.
Aminia	3	0	10	0	10	0	rec.	0
Agawam	10	39	7	44	12	21.5	upr.	34.8
Banner	8	82.5	10	67	12	72.5	"	74
Barry	5	0	10	0	3	0	rec.	0
Brighton	7	.7	10	0	14	0	"	.23
Caco	9	73	10	71	11	64.1	upr.	69.4
Campbell	5	60	9	58.1	11	54.1	"	57.4
Champion	3	20	10	50	12	17.1	"	29
Charlton	4	6.25	10	0	4	0	rec.	2
Chasselas avec Royal	5	100	.....	.....	12	83	upr.	91.5*
Chasselas avec Vibert	4	0	10	0	12	0	rec.	0
Colerain	7	22.8	9	34.4	12	47.9	upr.	35
Concord	10	66	8	51.2	12	52.5	"	56.5
Delaware	10	82	9	89.4	12	56.25	"	75.8
Diamond	10	96	10	89	12	80.8	"	85.3
Diana	10	81	10	74	12	79.2	"	78
Duchess	7	85.7	5	85	12	75	"	81.8
Eaton	4	40	6	20.8	12	57.9	"	39.5
Early Ohio	10	77	.....	.....	12	34.16	"	55.6*
Eclipse	10	0	10	0	.....	.....	rec.	0*
Elvira	8	91	8	84.3	12	87.5	upr.	87.6
Green's Early	9	90	7	86.4	12	59.6	"	78.6
Hartford	3	76	7	18.4	13	35.4	"	43.2
Herbert	10	0	10	0	12	0	rec.	0
Herman Jaeger	4	55	.....	.....	11	58.75	upr.	56.9*
Hayes	8	0	10	0	12	0	rec.	0
Hicks	13	31	9	51.6	12	40.8	upr.	41.1
Iona	7	78.5	5	50	11	38.6	"	55.7
Isabella	5	14	10	17	10	23	"	18
King	8	60	8	25.6	12	62.1	"	49.2
King Philip	5	0	10	0	12	0	rec.	0
Lindley	10	0	10	0	12	0	"	0
Lucille	2	6.5	9	57.2	12	79.6	upr.	47.4
Lutie	9	78.8	9	72.7	9	16.4	"	55.9
Manito	8	48.7	9	31.4	10	21	"	33.7
Mary	7	0	8	0	11	0	rec.	0
Massasoit	10	0	9	0	12	0	"	0
Merrimac	.....	.....	.....	.....	2	0	"	0*
Moore Early	10	57	10	43.1	12	65.4	upr.	55.2
Moyer	9	0	10	0	12	0	rec.	0
McPike	9	68	10	58	12	45.8	upr.	57.3
Niagara	20	62	8	54.3	12	10.4	"	42.4
Pense Malaga	3	100	10	99.5	4	77.5	"	92.3
Perkins	10	76	8	38.1	.....	.....	"	57*
Pierce	6	51.6	8	16.2	12	30.8	"	32.8
Pocklington	8	77.5	9	57.7	11	78.6	"	71.2
Read	9	74.4	5	98	12	72.5	"	81.6
Rogers 24	10	0	7	0	9	0	rec.	0
Rogers 36	7	0	10	0	4	0	"	0
Salem	10	0	10	0	6	0	"	0
Vergennes	12	58	10	48.6	12	29.2	upr.	45.2
Wilder	10	0	8	0	4	0	rec.	0
Wilkins	7	57	5	30	12	50.8	upr.	45.9
Winchell	9	90	7	85.7	12	53.75	"	76.5
Worden	8	75	8	33.7	9	47.8	"	52.1

*Average of less than three years.

Value of Certain Self-Fertile Varieties as Pollenizers for Certain Self-Sterile Varieties: This experiment, started in 1915, is being conducted to determine the value of the following self-fertile varieties of grapes: Campbell, Concord, Niagara, and Worden as pollenizers for the following self-sterile and partly self-fertile varieties: Agawam, Lindley, Massasoit, Brighton, Herbert, Salem and Wilder.

Record is kept of the number of flower clusters pollinated, the final number of flower clusters (some lost by wind, etc.) the average per cent. of fruit set, and the lowest per cent. set. Two years' results, though hardly sufficient on which to base final conclusions, indicate Worden to be by far the best pollenizer of the four, with Campbell second followed by Niagara and Concord, the latter two being practically equal.



The bee as a factor in grape blossom pollenation. Tent of mosquito netting covering a grape vine and a hive of bees.

Ringing Grape Vines: This experiment was outlined in the annual report for 1915 and results for that year were also given there. The experiment was continued in 1916 and 1917 practically as outlined, with results very similar to those secured in 1915. The work for the three years seems sufficiently conclusive to state that ringing may be best done, considering size of berry and bunch, from three to four weeks after the bloom opens or approximately the last ten days of July.

The Honey Bee as a Factor in the Pollination of the Grape: A new experiment begun in 1916 was one to determine the value of the honey bee as a factor in the pollination of grape flowers. This experiment was considerably interfered with owing to the fact that the bees would not work while in captivity. Where a vine of the Herbert variety was enclosed with one of the Concord variety

under a tent of mosquito netting and a hive of bees included, the bees simply swarmed in a convenient angle of the tent and refused to work on the blossoms. The result was that no fruit set on the self-sterile Herbert vine. However, in spite of the fact that the bees did not work the experiment was carried out as outlined below:

Outline of Experiment.

Row 34,	vine 15	Herbert	x Vine 15, Row 33, Concord	}	To be covered with mosquito netting.
" 34	" 17	"	x " 17 " 33 "	}	Bees enclosed.
Row 34	" 23	"	}		Covered with mosquito netting.
" 34	" 25	"	}		Bees and syrphid flies excluded.
Row 34	" 2	"	}		Covered with cheesecloth.
" 34	" 25	"	}		All insects excluded.
Row 32	" 17	Concord	x Vine 17, Row 31, Campbell	}	Covered with mosquito netting.
" 32	" 15	"	x " 15 " 31 "	}	Bees enclosed.
Row 32	" 22	"	}		Covered with cheesecloth to exclude all insects.
" 32	" 23	"	}		

The tents of mosquito netting and those of cheesecloth constructed over the vines were of sufficient size to more than allow for the full normal development of the shoots during the period they were covered.

To ascertain the part wind plays in the pollination of grape flowers, microscope slides smeared with vaseline and fixed in sheets of paper were exposed just outside the mosquito netting covering those vines selected for the experiment. These slides were examined once daily.

A hive containing a small colony of bees and a few frames of honey was placed under each of the four mosquito netting tents and conditions made to approximate normal as far as possible.

Spraying Experiment: Owing to the high price of copper sulphate it was thought advisable to test the value of ferrous sulphate as a possible substitute for the much more expensive copper sulphate. At first, there was some doubt as to the fungicidal value of ferrous sulphate solution since iron belongs to a different group of elements than copper. But on the possibility of ferrous sulphate solution having a fungicidal value and not being harmful to plants when used with lime, it was decided to try it out. Mr. Joseph Culp, of Vineland, very kindly placed his vineyard at our disposal for this experiment.

The experiment was outlined so as to determine the comparative fungicidal value of (1) ferrous sulphate, (2) a mixture of equal parts ferrous sulphate and copper sulphate, and (3) copper sulphate spray (Bordeaux mixture). The vineyard used in this experiment consisted of six rows of sixty-nine mature Concord vines each.

The various sprays were applied at three intervals: (1) Just before the blossoms opened, (2) a week after the flowers had fallen, (3) two weeks after the second spray.

No burning or injury could be observed from the first two sprays. After the third spray some injury was found on the leaves and fruit of the vines sprayed with ferrous sulphate. Spots on the leaves and fruit where drops of spray had collected and evaporated were burned somewhat. There was much less burning and injury to the fruit in the case of the ferrous sulphate and copper sulphate mixed than in the case of the ferrous sulphate alone, and none at all in the case of copper sulphate.

Observations on the Effectiveness of Various Sprays Used.

Ferrous Sulphate: Stem of clusters mildewed badly, some, in fact, so much so that they had shrivelled giving the bunch a wilted appearance. Berries slightly below normal size and a few mildewed slightly. Mildew not sufficient though to spoil the sale of the grapes; they would still pass as No. 1's.

Copper Sulphate and Ferrous Sulphate: Stems of clusters mildewed badly. In some cases mildew was so bad that the berries on some of the smaller clusters did not color fully and some dropped. Berries smaller than those in the row sprayed with copper sulphate.

Copper Sulphate: Stem of clusters mildewed slightly but still green and mildew not sufficient to have prevented the berries from reaching full normal size. Berries not affected.

Check: Stem of clusters mildewed badly, so much so that they have turned brown and begun to shrivel. Berries slightly mildewed. Mildew was sufficient to have prevented the berries from reaching full normal size. Berries on some of the smaller bunches not colored fully and many had dropped because of mildew.

Currants and Gooseberries.

The block devoted to the bush fruits includes sixteen of the leading varieties of black currants, fifteen red currants, two white currants and thirty-three gooseberries. During the summer of 1916 complete descriptive blanks were drawn up for both currants and gooseberries and each of the sixty-six varieties represented has been described for both fruit and bush characters. In addition to this, records have been kept for each bush on the blooming dates, amount of bloom, date of first fruit, date of picking and amount of fruit picked.

An attempt was made to conduct storage tests with the different varieties of red currants and gooseberries, but the cold storage is so unsuitable for such work that the tests were failures. Mold developed on the berries a few days after they were put in the storage.

Both currants and gooseberries were severely attacked by saw-fly larvæ early in the 1916 season. To check this the bushes were sprayed with arsenate of lead, 3 lbs. to 40 gallons of water, on June 1st. Again on June 12th the gooseberries were sprayed with Bordeaux mixture, 4:4:40 to control the mildew.

Observations in 1916 and 1917, together with the records of previous years, point to the fact that certain new varieties of black currants, little grown commercially, are heavier yielders and possess certain characters such as uniformity in ripening, earliness (in the case of the Eclipse) and ease in picking, which should recommend them to the grower commercially. These promising varieties are: Eclipse, Kerry, Climax, and the better known one, Saunders.

Raspberries.

Experiment to Determine the Value of Irrigation: This experiment was started in 1915 using the three varieties: Herbert, Cuthbert and Marlboro. In that year the results were negative, no increase in yield being noted over the non-irrigated block. Where the soil was kept moist and the bushes somewhat wet from the irrigation and rain, the fruit proved to be soft and much of it was unfit

for shipment. In 1916 more definite results were obtained as shown in the following table:

TABLE XXVII.—IRRIGATION OF RASPBERRIES.

	Color of Canes		Length of Canes in feet		Diam. of Canes in inches		Yield in Qts. per acre	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Marlboro ..	Bronze Yellow.	Yellow-Green ..	4′ 4″	5′ 1″	.37	.43	1,869.4	2,459.9
Cuthbert ..	Red	Whitish	5′ 2″	6′ 2″	.37	.5	2,023.7	5,016.8
Herbert ...	Dull Purple Bronze	Greenish White..	5′	5′ 6″	.37	.43	2,898.9	4,414.0

Remarks: Eight per cent. of Cuthbert canes bent over in irrigated block against four per cent. in non-irrigated.

A quite marked increase in yield from the use of irrigation would naturally be expected in a season such as 1916 since the weather was very dry during the picking season. The increased yields from the irrigated section might therefore be said to be due to the *decreased* yields on the non-irrigated section from the effects of drought.

STRAWBERRIES.

The work on strawberries is a continuation of the variety testing (including test of irrigation) and description work started in 1914. Eighty-three varieties were tested in 1916, forty-five of these being in the old patch bearing a second crop, and which did not bear as well comparatively as the varieties in a younger plantation. This younger patch consisted of new seedlings from the Central Experimental Farm, Ottawa, some other new varieties and a few common and improved varieties not included in the old patch.

This new patch, set early in the spring of 1916, included all of the better varieties of the old patch as well as the promising ones of the younger patch previously mentioned, so that it was expected the yields for 1917 would furnish a fair comparative test of the merits of the various varieties. The yields, recorded previously to this, cannot be taken as a fair test since the plantations were of different ages and in addition, soil, etc., varied to some extent in different parts of the plantations. Unfortunately the weather conditions were such that no reliable records could be secured from the 1917 crop.

In addition to the testing work, descriptions and notes were taken as to earliness, blooming dates and hardiness. The blossoms were described as to whether they were perfect or imperfect and other remarks made where necessary. A number of varieties were tested at the Station factory for jam making purposes. These are reported on in the by-products report.

CLASSIFICATION OF VARIETIES AS TO BLOOMING SEASON: In the Station plantation in 1916 the following varieties of strawberries bloomed between May 12th and 15th, and may, therefore, be classed as *Early Bloomers*: Americus, August Luther, Bederwood, Brandywine, Clark's Seedling, Crescent, Excelsior, Haverland, Longfellow, Magoon, Michael's Early, Molena, St. Louis' Prize, Senator Dunlap, Superb, Texas, Thompson's Seedling, Warfield.

Mid-Season Bloomers: May 19th-24th: Cassandra, Clyde, Commonwealth, Cordelia, Doran, Downing's Bride, Early Ozark, Enormous, Helen Davis, Highland, Jessie, Jocunda, Julia, Kellogg's Prize, King Edward, Lovett, Mariana, Marshall, New York, Parson's Beauty, Pocomoke, Ruby, Sample, Sharpless, Splendid, Staples, Steven's Late, Tennessee Prolific, Wm. Belt, Woolverton, Valeria, Virgilia.

Late Bloomers, May 26th-29th: Aroma, Bubach, Buster, Cardinal, Chesapeake, Desdemona, Enhance, Fendall, Gandy, Goodall, Highland Beauty, Heritage, Island King, Jerome, Joe, Klondyke, Lady Thompson, Lettie, Ohio Boy, Ophelia, Orem, Portia, Queen Mary, Three W's.

Storage Test of Strawberries: No adequate storage tests could be made with the Station cold storage, but some of the more important commercial varieties were sent to the cold storage plant at Grimsby and tested there.

From notes made there it would seem that much depends on the condition of the berries before cooling takes place. With the four varieties reported on the least waste was recorded with slow cooling to 40 degrees F. They were kept at this temperature for four days. A lower temperature of 32 degrees F. for the same time caused slightly greater loss, also a higher temperature of 60 degrees or 65 degrees F. for two days gave considerable more waste. Thirty-five to 37 degrees F. would seem to be the best temperature for storage and if the berries are not too mature they will hold for at least four days at this temperature. However, to make the greatest use of cold storage the storage shoud be close enough at hand so that the berries may be placed in it very shortly after picking.

Sprays to Kill Chickweed: In the spring of 1916 an experiment was outlined to determine the value from the application of different salt solutions in destroying chickweed in strawberry plantations. The following salt solutions were used on different plots:

Table XXVIII.—Outline of Chickweed Spraying Experiments.

Plot	Salt	Dilution with water		Plot	Salt	Dilution with water	
		lbs.	gals.			lbs.	gals.
1	Ferrous Sulphate	5	40	9	Ferrous Sulphate.....	20	40
2	Sodium Chloride	1	1	10	Calcium Chloride.....	2	1
3	" "	3	1	11	" "	4	1
4	Calcium Arsenite	1	40	12	Ferrous Sulphate	1	1
5	Ferrous Sulphate.....	10	40	13	" "	4	40
6	Calcium Chloride.....	3	1	14	" "	3	40
7	Sodium Chloride	2	1	15	Sodium Arsenite.....	¾	40
8	Check	.....	.....	....		.....	.....

These solutions were applied at the rate of .0555 gals. per square foot or 1 gal. to a row 12 ft. long and 1½ ft. wide. Mr. Norman Moyer very kindly allowed us the use of a portion of his strawberry patch for this experiment. All applications of spray were made by the same man using a knapsack sprayer.

After the first application the use of the following sprays, sodium chloride (3 lbs. to 1 gal water), calcium chloride (3 lbs. to 1 gal. water), sodium chloride (2 lbs. to 1 gal water), calcium chloride (2 lbs. to 1 gal water), was discontinued because of their markedly injurious effect on the foliage and even the roots of the strawberry plants. None of the solutions used controlled chickweed satisfactorily without injuring the strawberry plants to such an extent that practically no fruit

was produced. This fact makes spring spraying of strawberry plants with the solutions given in Table XXVIII impracticable. Spraying shortly after the fruit has been harvested and until fall frost kills the weeds may, however, prove more satisfactory. An endeavor will be made to carry out such an experiment another season. Up to the present it has been impossible to continue the work owing to scarcity of help.

Propagation Experiment: An experiment to determine the relative value of strains of berries of the same variety producing a large number of runners and those producing relatively a very small number of runners was started in 1914. The Williams variety is being used in this work. To date no information of value is available.

Strawberry Plants Distributed: A number of plants of a few of our best varieties were sent out to a few growers, also a large selection of varieties was sent to the Monteith Demonstration Farm and to the new Plant Breeding Station at Fort William.

The work on asparagus is a continuation of the experiments started in 1914 and 1915, and which were outlined in the 1915 annual report. Variety tests of nine varieties and selections are being carried on; irrigation tests and yield of male *vs.* female plants.

In 1917 seed of a specially selected strain named Washington was received from the Bureau of Plant Industry, United States Department of Agriculture. This strain is supposed to be rust resistant and very productive. The young plants

Overhead irrigation of vegetable crops at the Experiment Station.

made excellent growth and looked much thriftier and remained green longer than plants from seed which we saved from the Giant Argenteuil variety.

Yield of Male vs. Female Plants: This experiment has been discontinued in view of the fact that even if marked differences were observed in the yield such results would be of little practical value as the number of male or female plants in a plot is not controlled and is at all times a variable character. In 1916, the last season for which records were made in this experiment, the female plants slightly outyielded the male plants. The average yield per plant per cutting season for the male plants was .040 pounds and for the female, .0411 pounds. In point of numbers female plants appear to outnumber the male plants about two to one.

Irrigation Experiment: The irrigated plot outyielded the non-irrigated by 656 lbs. in 1916. The amount of water required to secure this increase was ten acre inches applied the previous season (1915). At a cost of $3.50 per acre inch, this makes the total cost for irrigation $36. It perhaps ought to be explained that the increased vigor and growth resulting from regular applications of

water during the summer shows itself in an increased yield the following spring. In 1917 the irrigated plot outyielded the non-irrigated by 850 lbs. per acre. The average yield per plant for 1917 was .404 lbs. for irrigated and .273 lbs. for non-irrigated. This increase was obtained by the application of 8.5 inches of water the previous season.

Beets.

Irrigation and Fertilizer Experiment: The irrigation experiment on early beets was continued during 1916 with the addition of sodium nitrate applications. The plots for this experiment were sown on May 1st and made a good growth during the season. By July 25th the greater part of the roots had reached marketable size. All plots were, therefore, lifted and records made.

Table XXIX records the yields per acre in bushels for the roots and pounds per acre for the leaves. Ratio of roots to leaves by weight is also given and the gain in roots and leaves of the various treated plots over the non-irrigated, non-fertilized plots.

Table XXIX.—Irrigation and Fertilizer Experiment with Early Beets.

(Yields are in bu. per acre of roots and lbs. per acre of leaves.)

——	Roots bu.	Leaves lbs.	Ratio of Roots to Leaves by weight	Gain over Plot 1
No. 1. Non-irrigated, non-fertilized plot	71	5,930	1–1.6	
No. 2. Non-irrigated, fertilized plot	211	11,144	1–1.13	In roots, 140 bu. per acre. In leaves, 5,214 lbs. per acre.
No, 3. Irrigated, non-fertilized plot	111	10,032	1–1.80	In roots, 40 bu. per acre. In leaves, 4,102 lbs. per acre.
No. 4. Irrigated, fertilized plot.	248	18,868	1–1.52	In roots, 177 bu. per acre. In leaves, 12,938 lbs. per acre

A close study of this table would lead to the conclusion that the determining factor in increased yield of early beets is not so much irrigation as the frequent applications of nitrate of soda, for whether irrigated or not the fertilized plots far outyielded the non-fertilized plots. This fact is most forcibly expressed in plots 2 and 3. Plot 3, irrigated but non-fertilized, yielded 111 bushels per acre, while plot 2, non-irrigated, but treated with frequent applications of nitrate of soda, yielded 211 bushels per acre, or an increase of nearly 100 per cent. Comparing again the weight of leaves for these two plots and the ratio of roots to leaves by weight, it will be seen that the irrigated, non-fertilized plot produced much greater weight of leaves in proportion to the amount of roots produced than did the non-irrigated, fertilized plot. In other words the irrigation has tended to an excess of leaf production while fertilization has had the reverse effect, an increase in root yield. The total amount of water applied to the irrigated sections amounted to 2.9 inches (calculated per acre) at a cost of $10.44.

The total amount of nitrate applied was 800 lbs. per acre put on in five applications costing in all $26.80 per acre. Table XXIX shows an increase of 140 bushels per acre for fertilization alone (compare plots 1 and 2). This increase of 140 bushels was secured at a cost of $26.80.

Irrigation alone gave an increase of 40 bushels per acre (compare plots 1 and 3). This increase was secured at a cost of $10.44 as calculated above.

Carrots.

Similar work to that with beets has been carried on with early carrots. Results for 1916 are shown in table XXX.*

Table XXX.—Irrigation and Fertilizer Experiment with Early Carrots.

(Yields are in bu. per acre of roots and lbs. per acre of leaves.)

——	Roots bu.	Leaves lbs.	Ratio of Roots to Leaves by weight	Gain over Plot 1
No. 1. Non-irrigated, non-fertilized plot.....	117.7	7,050	1–1.2	
No. 2. Non-irrigated, fertilized plot.....	160	6,758	1–1.12	In roots 42.3 bu. per acre. Loss in leaves 292 lbs. per ac.
No. 3. Irrigated, non-fertilized plot.....	190	8,884	1– .9	In roots, 72.3 bu. per acre. In leaves, 1,794 lbs. per acre.
No. 4. Irrigated, fertilized plot	135.6	7,629	1–1.1	In roots, 17.9 bu. per acre. In leaves, 579 lbs. per acre.

The results with carrots as shown in this table were considerably different than those secured with early beets. In the beet experiment nitrate of soda gave by far the largest returns for the outlay on the crop. With the carrots, however, there is a light gain for nitrate alone but the largest gain is made from the irrigation alone. This indicates that with early carrots water is the determining factor. Further tests, however, must be made before definite conclusions can be drawn. Unfortunately, the work in 1917 was rendered negative by poor seed and an unsuitable site which was often under water during excessive rains.

In percentage of leaves to roots the nitrate for both beets and carrots decreased the amount of leaves to roots in all but one case, while irrigation increased the amount of leaves to roots in all but one case.

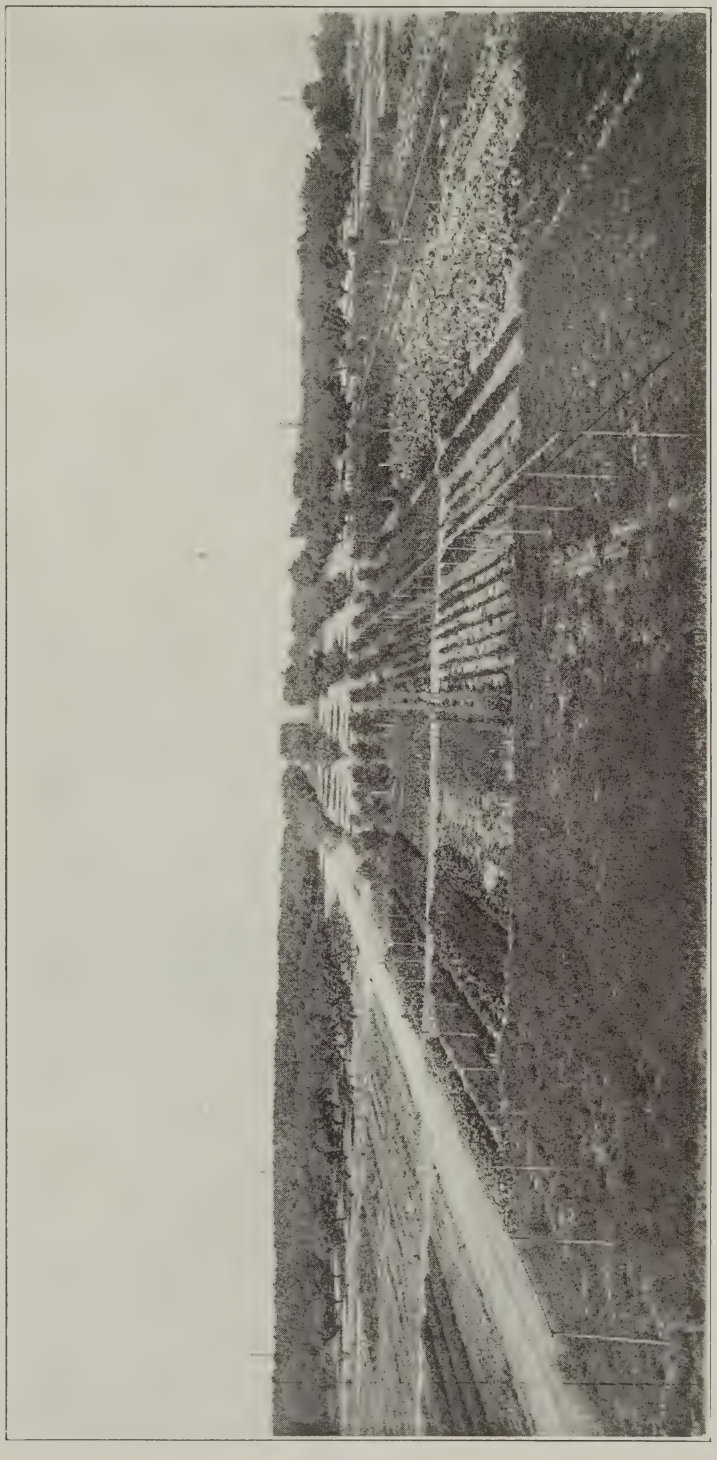
Celery.

Similar work to that already outlined for beets and carrots was carried on in 1915 and 1916 with celery, using Giant Pascal and Paris Golden varieties. Table XXXI sums up the results for 1916.

Table XXXI.—Irrigation and Fertilizer Experiment with Celery.

Plot	Treatment	Heads	Lbs.	Weight per head	Calculated Yield per acre
Paris Golden:					
No. 1.....	Irrigation and Nitrate.....	28	15	.54	10,800
No. 2.....	Irrigation, no Nitrate.....	39	18	.46	9,200
No. 3.....	Non-Irrigated and Nitrate ...	21	11	.52	10,400
No. 4.....	Non-Irrigated, no Nitrate....	21	8	.38	7,600
Giant Pascal:					
No. 1.....	Irrigation with Nitrate.....	76	50	.66	13,200
No. 2.....	Irrigation, no Nitrate.....	80	49	.51	10,200
No. 3.....	Non-Irrigated and Nitrate...	45	28	.62	12,400
No. 4.....	Non-Irrigated, no Nitrate....	45	18.5	.41	8,200

*A fuller account of this experiment was published in the Fruit Branch Circular for November, 1916.



Partial view of irrigated section. Cherry and peach orchards beyond.

The celery, on the whole, was quite short, while the quality was very good. The yields were taken by weight per head, being closely trimmed and prepared for market. The results were uniform for both varieties, nitrate alone giving the largest increase in yield for the money expended. The addition of irrigation to the application of nitrate gave a further increase of only 400 lbs. for Paris Golden and 800 lbs. for Giant Pascal.

Irrigation amounted to 8.1 inches per acre costing $29.16. Nitrate used amounted to 605 lbs. per acre, costing $16.25.

In 1917 a similar experiment was carried on using White Plume variety. Results were more marked than in 1916 as the following table indicates:

TABLE XXXII.—IRRIGATION AND FERTILIZER EXPERIMENT WITH WHITE PLUME CELERY.

Plot	Treatment	Heads	Total lbs.	Weight per head	Calculated yield per acre
No. 1	Irrigation and Nitrate	42	43	1.02	51,000 lbs.
No. 2	Irrigation and no Nitrate	42	41	.97	48,500 "
No. 3	Non-Irrigated and Nitrate	42	23	.54	27,000 "
No. 4	Non-Irrigated, no Nitrate	42	21	.5	25,000 "

In this experiment irrigation was the most important factor. While the nitrate made gains in both plots it was more noticeable when used in conjunction with the irrigation.

CORN.

Selection work in corn was started in 1914. At the present time five varieties of sweet corn are being grown, and a large number of selections of these have been made. Most of the selection work has been done with the Early Malcolm, the original strain of which was secured from the Central Experimental Farm, Ottawa. In 1916 the selections of Early Malcolm were practically one week in advance of Bantam. The work in 1917 was a failure owing to adverse weather conditions. 1916 seed, however, is still available to continue the work in 1918.

ONIONS.

IRRIGATION EXPERIMENT: Work similar to that carried on with beets and carrots was outlined for onions. The non-irrigated, non-fertilized plot yielded at the rate of 400 bushels per acre. The irrigated plot, 477.9 bushels, and irrigation with nitrate, 508.2 bushels per acre. No figures are available on the effect of nitrate alone. From the foregoing figures it will be seen that irrigation alone increased the yield 77.9 bushels and irrigation with nitrate increased the yield 108.2 bushels per acre over the untreated plot.

The quality of the onions, as a whole, was excellent, but the irrigated bulbs were not well matured and consequently were of poor keeping quality.

The cost of irrigating was $31.37 per acre.

SEED SELECTION: The seed selection work started in 1915 is being continued and extended. Specially good strains of Denia and Prizetaker have been developed.

Considerable success also has attended the work of starting onion plants in the greenhouse early in February and transplanting to the field early in May. Four varieties, Prizetaker, Denia, Red Globe and Red Wethersfield have been treated in this way, the first two giving considerably the best results.

Potatoes.

The selection work started in 1915 was continued during 1916 and 1917. In 1916 there were 56 selections of the variety Gertrude; 39 selections of Davies' Warrior, 57 of Carmen No. 3, and 5 of Delaware. This number has now been reduced to 114 and includes the variety Sir Walter Raleigh in addition to the above.

Northern vs. Southern Grown Potatoes as Seed Tubers: With a view to determine the relative productivity of Northern immature seed tubers in comparison with ordinary seed tubers produced in the Southern part of the Province, the following experiment was started in 1916.

Seed tubers (of the Early Eureka variety), secured from Kenora, Dryden, Monteith and Port Hope, were cut and planted on May 1st as follows:

Rows 1 and 2. Mature seed from Kenora.
Rows 3 and 4. Immature seed from Dryden.
Rows 5 and 6. Immature seed from Monteith.
Rows 7 to 10. Mature seed from Port Hope.

Carrots in bloom.

The experiment was conducted in duplicate. The soil was a rather heavy clay loam. The whole plot was sprayed three times during the season with Bordeaux and arsenate of lead.

In 1916 the Northern grown seed matured approximately a week earlier than the Southern seed, but none of the tubers were dug until July 31st, when the best sixty hills in each plot were selected and carefully weighed, giving the following results:

Mature seed from Kenora, 60 hills, 74.8 lbs.
Immature seed from Dryden, 60 hills, 87.4 lbs.
Immature seed from Monteith, 60 hills, 68.6 lbs.
Mature seed from Port Hope, 60 hills, 44.1 lbs.

The immature seed from Dryden was grown for only one year in the North, and the seed from Monteith for two years.

The unfavorable weather in 1917 rendered the results for that year very unreliable, hence they are not given here. In general, however, they bore out the 1916 results.

Tomatoes.

The seed selection work, as fully outlined in the 1915 report, is being continued. Several new varieties were added in 1916 making in all some 135 selections of over 30 varieties for that year. This number has now been reduced to 128 and includes also several strains received from C. E. F., Ottawa, and R. M. Palmer, B.C.

Vegetable Seed Production.

The work on the production of selected vegetable seed was continued during 1916 and 1917 with good success and especially so in the latter year. The original stock of Yellow Globe Danvers and Denia onions, Detroit Dark Red beets and Chantenay carrots is being used for this work with the addition of the following kinds and varieties of vegetables:

Cabbage: Danish Ballhead.
Celery: Giant Pascal and Paris Golden.
Cauliflower: Dwarf Erfurt.
Onions: Red Globe, Red Wethersfield and Prizetaker.
Parsnips: Hollow Crown:
Radish: Three varieties.
Salsify:

The seed produced in 1915 was used for most of our 1916 crops with the addition of a few others for comparison. Also a considerable amount of seed was sent out free in small lots to a large number of growers who reported on this seed at the end of the season. Some forty reports were received in 1916 and without exception all speak very highly of the quality of the seed, the germination in most cases being 20 per cent. or better than other seed. Carrots in a few cases proved to be low in germinating power.

In 1917 seed of the following vegetables was distributed to 76 individuals: onions, beets, carrots, parsnips, salsify, cabbage, celery and cauliflower. All reports were again very favorable.

Very fair success attended the production in 1916 of cabbage seed of the Danish Ballhead variety. A number of selected heads were placed in a bed with the root stock attached in the fall of 1915. A light covering of earth and snow was all the protection given. The heads came out in good condition in the spring and only a very small number failed to grow after being set in the row. Many of the heads required cutting or slitting to allow the seed stocks to burst through. Later in the season the tops required to be supported with stakes and strings. Seed ripened in late August and was harvested by making several cuttings.

Celery seed was produced with most success by planting the plants in the greenhouse from the field during the late fall. They began to grow in early spring and produced a large quantity of seed by the end of July. A number of plants were stored over winter in a trench, and some which lived over in cellar storage were planted out in the open in the early spring. A fair quantity of seed was produced but the growth of the plants and the seed produced was not as good as obtained under the first system outlined above.

Cauliflower seed was produced from plants which had just started to head in late fall and which were taken up from the field at that time and planted in a cool greenhouse over winter. The plants were left in the greenhouse and in early spring seed stocks were sent up from which ripened seed was secured in July.

An attempt to produce cauliflower seed outside from early plants resulted in failure owing to the weather being backward at the time of blossoming and setting seed.

Celery seed production. A celery plant in full bloom.

The object of this work in vegetable seed production is, of course, to demonstrate the possibilities in home grown seed and the best methods of raising such seed, as well as to secure better strains through seed selection.

Vegetable Seed Selections Received: The following selections were received and grown in 1917:

From Central Experimental Farm, Ottawa:

Corn: Early Malcolm, Early Otta.
Tomatoes: Alacrity, 1917, Burbank's Early 0.7495, Earliball 0.7464, Danish Export, 0.7463 M., Sunnybrooke Earliana 0.7453, Danish Export, 0.7462.
Citron: 0.5586 B.
Onion: Yellow Globe Danvers, C. E. F. 5464 XX.

Carrot: Chantenay, C. E. F. 5461-2.
Radish: Scarlet Turnip, White Tip, C. E. F. 5465.
Spinach: Victoria, C. E. F. 5466.
Parsnips: Hollow Crown, C. E. F. 5467.
Beet: Detroit Dark Red, C. E. F. 5452-1.
Lettuce: Grand Rapids, C. E. F. 5472-1.
Celery: Perle le Grand, C. E. F. 5463, French Success 1—C. E. F. 5448.

From R. M. Palmer, British Columbia. Selected strains of:

Russian Sun Flower.
Hubbard Squash.
Cabbage Lettuce.
Long Cream Vegetable Marrow.
Swiss Chard.
Long French Golden Carrot.
Sutton's Early Red, Burpee's Whole Salad Tomatoes.

From Chas. Young, Richard's Landing, Ont. Selected strains of:

Student Parsnip:
White Cory and Golden Bantam Corn.
Danish Ballhead and Winningstadt Cabbage.
Detroit Beet.
Red Globe Onion.

Irrigation.

Considerable use was made of the irrigation system during the latter part of the 1916 and 1917 growing seasons. A new line of pipe was laid from the pump to the packing house so as to make possible the shutting off of the farm water system during irrigation. By this means no dirty water is pumped into farm mains, and the irrigating mains leading direct to the nozzles give a good steady pressure for irrigating at all times.

The system was used with success on many crops including beets, carrots, cabbage, cauliflower, asparagus, onions, celery, raspberries and the old bed of strawberries. Below is given a table showing some of the crops which were irrigated in 1916, and the amount applied in inches for each month.

Table XXXIII.—Irrigating During Season of 1916.

——	Raspberries	Strawberries	Onions	Asparagus	Beets	Carrots	Celery
July.....	5	4.3	4.2	4.2	4	4	3.1
August.....	1.8	.....	1.1	.9	.....	.....	2.8
September.....	2.6	.....	3.4	3.4	.....	.....	2.2
Total	9.4	4.3	8.7	8.5	4	4	8.1

The rainfall per month for the six months, May to October, 1916, inclusive, is given below for purposes of comparison with the above table:

May, 1916.....	4.93″	August, 1916.....	.6
June "	4.67″	September "	1.33
July "	1.12″	October "	3.62

As will be seen the rainfall was very light during the three months, July, August and September, when the irrigation was given.

In 1917 it was not found necessary to use the irrigating system to such a large extent as in 1916 owing to the wet weather continuing so late in the season.

BY-PRODUCTS.

The following is the chief work being carried on by the By-Products Department:—

1. Variety tests of fruits for canning and jam making.
2. Investigation of maturing of grapes in the Niagara Peninsula.
3. Canning and jam making for Canadian Military Hospitals overseas.

Strawberries for Jam Making.

The rise in popularity of strawberry jam and the increasing quantity of strawberries used for that purpose has warranted a study of the product from several points of view. Growers and jam makers alike have wondered what varieties would give best results, first as yielders, second, as shippers, and third, as the finished article in the factory.

Side view of canning factory: Engine room, a receiving platform and motor truck.

In the summer of 1916 twenty varieties were made into jam separately. Each variety was given similar conditions except where noted in the data which follow. The proportions used in these jams were:—

Fruit	11 lbs.
Pectin	1 "
Sugar	15½ "

The fruit was placed in the kettle and brought to a boil. Then the pectin was mixed thoroughly with the hot fruit. Lastly, the sugar was added. The mixture was then allowed to boil vigorously until the boiling point had reached 220 deg. F.

The hot jam was cooled in granite dish pans, until it reached 185 deg. F. Sample bottles of each jam were filled and the data and variety written upon the labels.

In judging the finished product the following points were noted:—

(1) Wholeness of the berry.

(2) Color of jam.

(3) Transparency of the fruit depending on the degree to which the sugar had permeated it.

(4) Flavor.

(5) Mould growth.

The following gives a description of each variety:—

Highland Beauty: Color, clear, deep red; fruit badly broken.

Glen Mary: Similar to No. 1, but not as deep nor as bright.

Chesapeake: Color, dull; fruit, partly broken and opaque; mould easily; flavor, fair; rather a poor jam.

Sharpless: Color, bright; fruit, partly broken and rather opaque, slight mould; flavor, good; fairly good jam.

Senator Dunlap: Color, very dark; fruit, bright but broken; no mould; flavor very poor; a very poor jam.

Scalding peaches to remove skins.

Desdemona: Color, very dark; fruit, rather broken but clear; slight mould; flavor rather poor; not very good.

Early Ozark: Color, fairly bright; fruit, tends to break; slight mould; flavor, very poor; a poor jam.

Excelsior: Color, a very dark, clear red; fruit, whole, a pleasing jam though rather dark.

Cordelia: Same as Early Ozark. (Cannot draw any definite conclusions from these two as the jams seem to have been made from bad pectin.)

Wm. Belt: Color, very good; fruit, bright and whole, no mould; flavor, very good; an excellent jam.

Pocomoke: Color, good; fruit, clear and whole, no mould; flavor very good; a very good jam.

Joe: Color, good; dark red; fruit, clear, partly broken; slight mould; flavor, good; a good jam.

Enhance: Color, bright red; fruit, whole and very transparent; *the most attractive jam of all.*

Parson's Beauty: Not properly made; fruit whole; probably a good berry.

Sample: Similar to Pocomoke in appearance and whole fruit; not quite as good in flavor; a good jam.

Williams: Color, dark; fruit, whole but dull in color.

Brandywine: Color, dark; fruit, whole and clear; flavor, fairly good; a fairly good jam.

Island King: Color, dark; fruit, whole and clear; flavor, fairly good; a fairly good jam.

Klondyke: Color, dark and clear; fruit, whole and bright; flavor good; would make a fairly good jam.

Superb: Color, dark; fruit, whole and bright; flavor good; would make a fairly good jam.

The results of the strawberry tests have not been conclusive. The number of varieties was limited and conditions were not as uniform as desirable. The work, however, will be continued more thoroughly.

Owing to the exceptional strawberry season it was impossible to obtain suitable samples in 1917 for continuing the jam making tests made in 1916.

In the case of cherries, black currants, red currants and gooseberries many varieties were obtainable and hence a study has been commenced of these fruits for canning qualities. In this set of tests all fruits were canned in glass. After having prepared the fruit by washing, it was placed in clean jars, covered with a sugar syrup containing 50 per cent. by weight of granulated sugar and cooked at 212 deg. F. Cherries, currants and gooseberries were cooked 20 minutes. Raspberries were cooked for 5 minutes.

Cherries.

Fouche Morello: Fruit and syrup very deep red, fruit being scarcely visible in syrup; flavor probably poor but impaired because of slight fermentation; fruit has held form well.

Double Natte: Color of fruit and syrup ideal, being of a deep, dark red, somewhat lighter than Fouche Morello; flavor slightly sweet.

Ostheim: Color too dark; flavor very acid; fruit small.

Leib: Color same as Double Natte; flavor pleasing, sweet but with some acidity; fruit firm.

Weir: Lightest in color of varieties so far; fruit shows light through the syrup; flavor acid and bitter; fruit soft.

Dyehouse: Medium red color, fruit being rather light in color; flavor excellent, sweet with acidity; fruit very small.

Late Duke: Lightest of medium red varieties, too light; samples fermented, spoiling flavor.

Richmond: Color slightly darker than Late Duke; flavor acid and bitter; fruit soft.

Montmorency: One of the best medium red varieties; flavor almost as acid as Richmond.

Ontario Preserving: Darkest and best color of medium red varieties; flavor poor, acid and bitter.

Windsor: Light pink color; very sweet and lacking in acidity; fruit firm.

Ida: White color, all samples badly fermented.

Summary: The variety Leib because of its superior color and flavor must be placed first. Dyehouse, though a small fruit, stands second because of its excellent flavor. This experiment should be continued. A greater number of varieties and more representative samples would give more conclusive results.

Black Currants.

The varieties Magnus, Boskoop Giant, Baldwin, Black Victoria and Black Naples were tested.

There was practically no difference in color.

Black Naples had the most pleasant flavor, being quite sweet. The texture of the fruit was fine and soft.

Boskoop Giant was almost as good but a little coarse in texture.

Magnus, Baldwin and Black Victoria were all too bitter in flavor.

All samples were lighter in color and less sweet in flavor than currants packed in enamel lined tin cans.

Red Raspberries.

Cuthbert: Was found superior to Herbert and Marlboro, a bright, rich red.

Herbert: Was almost as good as Cuthbert in color and just as good in flavor, sweet but not insipid.

Marlboro: Was light in color and flat in flavor.

Red and White Currants.

Fay Prolific: Sweetest and most pleasing flavor; color almost as bright a red as Victoria Red.

Victoria Red: Flavor rather bitter, finest color, deep clear red.

Versailles: Flavor bitter and color no better than Fay Prolific.

Wilder: Poorest flavor and color.

White Grape: The only white variety; flavor fair.

Ruby Castle: Badly fermented.

Gooseberries.

Of the twenty-three varieties of gooseberries tested four were especially good canners. The variety Leader had the best combination of qualities, being light green in color, medium in size, sweet flavor, tender and free from prickles.

Josselyn had the finest flavor of any variety but was too small. It ranked second.

Champagne Red was good in every respect except color. Red color at present cannot be recommended for canning.

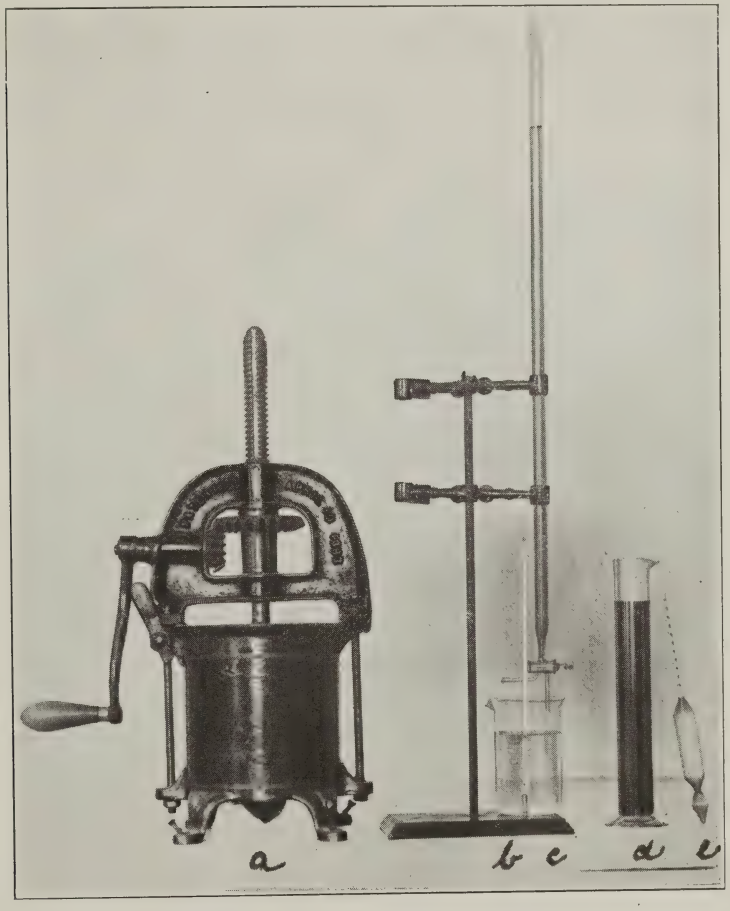
Crown Bob had to be placed fourth on account of a sour flavor. Otherwise it was as good as Leader. Twenty-three other varieties were tested. Only the best varieties are, however, mentioned in this report.

Maturing of Grapes in the Niagara Peninsula.

Most fruit growers have realized that the maturing of grapes depends more upon the nature of the soil than any other one factor. In some districts the vigor of the foliage has been lessened by attacks of fungus diseases. Although

such attacks have interfered with the development of sugar in the fruit, just as frost or severe summer pruning will also act, yet the number of grapes so influenced is small compared to the grapes affected simply by differences of soil.

The result has been that grapes have been marketed at various stages of maturity. Growers have been influenced by the high prices being obtained for the first fruit on the market. But if a grower on one soil is able to market his grapes on a certain day it does not follow that a grower on a different soil should market his fruit on the same day.



Apparatus used in grape test-work.

Accordingly, during the summer of 1916, a preliminary study of grape growing in the Niagara Peninsula was made. It was found that in all districts growers were willing and anxious to supply us with samples which we might test for sugar and acidity. Apparently it is becoming well understood that the marketing of immature grapes is a serious matter. For dessert purposes unripe grapes are worthless and it does not take many such grapes to shake the confidence of the consumer.

Following is a list of the districts visited together with the type of soil from which samples of grapes were secured:—

District	Soil	District	Soil
Burlington	Gravel	Beamsville	Clay
Jordan	Sand	Vinemount	Clay
Vineland	Sand loam	Stamford	Clay loam
Port Dalhousie	Sand loam	Experiment Station	Clay
Fonthill	Sand	St. Catharines	Clay
St. David's	Mountain wash	Homer	Black Muck
Winona	Mountain wash		

An attempt was made to obtain from each of these districts the following varieties: Concord, Delaware, Niagara, Brighton, Worden, Wilder, Moore Early, Campbell Early, Champion, Diamond, Agawam, Lindley and Vergennes. The varieties Herbert, Moyer, Hartford, Pocklington, Isabella, Lutie and Lucille were collected occasionally.

The plan was to visit all of the districts within two days. By repeating visits as often as possible (not more than a week elapsing) it was felt that the maturity of all varieties could be traced and that the development on the various soils might be fairly compared. Unfortunately, it was not always possible to follow this plan entirely and hence the results obtained are not as conclusive as they might be.

Methods of Testing: Each sample as collected was placed in a 20 lb. paper bag upon which was written the date, variety, name of grower, district, soil and marketability. A sample weighing about 2 lbs. was found to be sufficient. On page 73 is shown most of the apparatus used in making the laboratory tests.

The grapes were first crushed in a granite dish and then placed in the press marked "a." Enough juice had to be collected to fill the glass cylinder "d" within an inch of the top. The size of "d" is important. It should be one and one-half inches in diameter and twelve inches in height. This is the smallest size which will enable one to float the spindle (saccharometer or hydrometer) "e" within it. The spindle "e" is graduated in degrees Balling or Brix. That is, the reading it gives is approximately the percentage of sugar by weight contained in the grape juice. The temperature of the juice is then taken and any necessary correction in the reading made.

Having thus obtained an approximation of the sugar content of the grape juice (by a simple method which might easily be duplicated by any grower or inspector) the sample is then tested to find the percentage of free acid, expressed in terms of tartaric acid.

Results: In spite of the incompleteness of the 1916 results a great deal of instructive and accurate information was procured.

In 1917 it was possible after the experiences of 1916 to carry on the work more efficiently than in 1916.

The visits to the various vineyards were completed within two days. Thus the tests were fair to all districts. Visits were repeated regularly each week.

By obtaining samples of each variety regularly at different periods in its ripening it was possible to follow closely the development of the grape. When

cutting the sample we endeavored to decide whether the fruit came under any of the following categories:—

(*a*) Dead ripe.
(*b*) Ripe.
(*c*) Edible.
(*d*) Non-edible.
(*e*) Edible but frosted.
(*f*) Non-edible and frosted.

The results obtained in 1917 have tended to confirm the conclusions drawn from the work of 1916. Grapes grown on the heaviest soils have matured quicker than those grown on the lighter soils. This was particularly noticeable during the 1917 season. All grapes were later. None developed as high a Brix-acid ratio (see explanation later) as in 1916. But only those on heavier soils were really fit for marketing when the early frosts came.

Basket of cans, filled, exhausted, sealed and ready for cooking retort.

It should be noted that increased elevation has tended to overcome soil. Thus Vinemount clay, unlike most other clay soils, has produced a slow maturing grape. The muck soil of Homer has again produced the leading quality grape.

In classifying the samples of grapes at the time of cutting greatest importance was placed upon the decision—whether a grape was edible or non-edible. This is the vital question in marketing grapes. The table which follows has been derived from detailed tables by averaging the figures for composition when the grape was *first* classified as "edible." In some cases samples from the same vineyard continued to be classed as merely "edible" for two or three weeks. Classification beyond "edible" is difficult. As a matter of fact in 1917 not one sample was classed "a," dead ripe. Because we were evidently too strict in our demands for classes "a" and "b" it is evidently fairest only to average composition when class "c" *first* appeared.

The figures in this table represent the greatest acidity, the least sugar content and the lowest B. A. R. (Brix-acid Ratio) which a variety should have for marketing.

The column headed Brix contains the approximate percentage of sugar. The acid column contains the percentage of free acid expressed in terms of tartaric acid. The column headed B. A. R. represents the Brix reading divided by the acidity. The Brix-acid Ratio is the one figure which gives the key to the condition of the grape. The higher the ratio the greater the edibility.

TABLE XXXIV.—AVERAGE COMPOSITION OF GRAPES WHEN FIRST CLASSIFIED "EDIBLE."

Variety	No. of Samples	Brix	Acid	B. A. R.
Concord	11	12.95	1.27	12.0
Worden	14	11.64	1.41	8.3
Niagara	8	13.27	.8	16.6
Campbell	8	11.3	1.73	6.5
Moore	15	11.57	1.68	6.9
Delaware	6	13.39	1.75	7.6
Lindley	3	12.02	1.54	7.8
Vergennes	2	13.3	1.42	9.4
Brighton	4	14.8	1.18	12.5

It is hoped that this investigation may be continued for at least one more year. The work of 1916 was preliminary and, of course, the season of 1917 was abnormal.

MATURING OF GRAPES AFTER CUTTING.

A further experiment dealing with the maturing of grapes has been summarized in the following tables. In order to determine definitely whether grapes ripen after cutting, several tests were made in 1916 of similar samples at the beginning and end of a week. The results demonstrated that there was practically no change after standing for this length of time.

TABLE XXXV.—TESTS SHOWING THE CHANGES IN SUGAR CONTENT AND ACIDITY OF GRAPES AFTER CUTTING.

Variety	Analysis Oct. 3rd and 4th		Analysis Oct. 11th	
	Sugar ° Balling	Acidity	Sugar ° Balling	Acidity
Lindley Seedling	15.5°	.7 %	17. °	.71%
Brighton	16.7	.69	17.9	.6
Niagara	14.4	.63	15.1	.61
Concord	15.1	.64	15.4	.73
Delaware	20.1	1.27	18.8	1.05
Campbell Early	13.7	.84	12.1	.85
Average	15.9	.79	16.1	.76

The analyses on Oct. 3rd and 4th were made immediately after cutting. The Oct. 11th analyses are of fruit from the same samples one week later.

TABLE XXXVI.—TESTS SHOWING CHANGE IN SUGAR CONTENT AND ACIDITY IN GRAPES AFTER CUTTING.

Variety	Sept. 30th analyzed immediately after cutting		Oct. 10th, remainder of samples taken Sept. 30th	
	Sugar ° Balling	Acidity	Sugar ° Balling	Acidity
Wilder	12.7°	1. %	13.1°	.83%
Niagara	13.2	.61	14.2	.57
Niagara	11.3	.61	11.6	.49
Concord	12.3	.84	13.5	.76
Concord	14.8	.59	13.7	.46
Worden	15.4	.67	14.8	.64
Lindley	16.3	.74	16.6	.61
Total	13.7	.72	13.9	.62

FRENCH CRAB APPLES FOR CIDER.

It has often been thought that a large percentage of Ontario apples might well find an outlet in the form of cider. While this is undoubtedly true it is believed that our cider will never be a great success until we select the proper varieties and develop the most reliable methods of manufacture.

In Europe cider is consumed in large quantities. Special varieties have been produced for the purpose.

Through the kindness of the United States Department of Agriculture it has been possible to obtain scions of the following varieties of French Crab apples: Martin Fessard, Blanc Mollet, Frequin Rouge, Bramtot, Grise Dieppois and Amered Berthcourt.

These varieties have been top grafted upon five-year-old apple trees. It is hoped that in possibly three or four years it will be possible to examine the French Crabs at first hand.

While the growth of the imported stock is progressing a study will be made of the cider question. Much work is being done in this matter in America and it is quite likely that either cider or some form of apple extract will become a popular beverage.

CALIFORNIA CANNING PEACHES.

In the spring of 1916 four trees each of several leading varieties of California canning peaches were planted in the Experiment Station orchard. The same summer bud sticks were taken from these young trees to a local nursery and propagated. During 1917 these buds have made growths of varying strengths. The young trees have been dug and are now heeled in ready for 1918 planting.

The list includes:

9 trees Lovell.
9 " Phillip Cling.
31 " Foster.
15 " Runyon Cling.
14 " Tuscan Cling.
30 trees Libby Cling.
12 " Heath Cling.
42 " Peak Cling.
5 " McDevitt Cling.

Different growers are anxious to try these varieties. We shall, therefore, be able to test these California varieties not only for canning purposes but also for productivity and suitability for conditions in Ontario.

Brine in Canned Asparagus.

Optimum Strength of Brine: Owing to the fact that various well known authorities have advocated quite different strengths of brine for canning asparagus a simple test was made in order to determine which brine was best suited for conditions in Ontario.

The following table shows the results briefly:—

Table XXXVII.—Use of Brine in Canning Asparagus.

% Salt in Brine	Salt per Imp. gal. water.	Remarks
1%	1⅜ oz.	Flavor too flat; very slight darkening of tin plate.
2%	3⅛ "	Flavor excellent, just enough salt; considered slightly too salty by others; slight darkening of tin.
3%	5 "	Flavor considered excellent by some, slightly too salty by others: slight darkening of tin.
4%	6⅝ "	Considerably too salty; tin considerably darkened.
5%	8⅛ "	Much too salty; tin badly darkened.
10%	1 lb. 1¾ oz.	Great excess of salt; asparagus dark; tin greatly darkened.

The asparagus used in this pack was carefully washed and trimmed.

Blanching was done by dipping the stalks in boiling water for 9 minutes.

The stalks were then packed in No. 2 sanitary cans, weight 10 oz. net. The various brines were then added, cans sealed and processed in a closed retort for 15 minutes at 240 deg. F.

Cans were cooled after processing.

Acidified Brine: It has been stated in California that if the brine used on vegetables be acidified by the use of lemon juice, tartaric acid or vinegar, the vegetables may be much more easily sterilized.

The process was given a trial. Asparagus was canned both in glass jars and in plain tin cans. To each imperial gallon of 2 per cent. brine was added 6 oz. of lemon juice. The acidified brine was added in the usual manner but the containers were merely boiled at 212 deg. F., the glass jars for 45 minutes and the 2 lb. tins for one hour. Although samples are being held in warm rooms not a single instance of spoilage has occurred during eight months.

The lemon flavor is not noticed by those who do not know of its presence. As yet no serious action has been found on the tin.

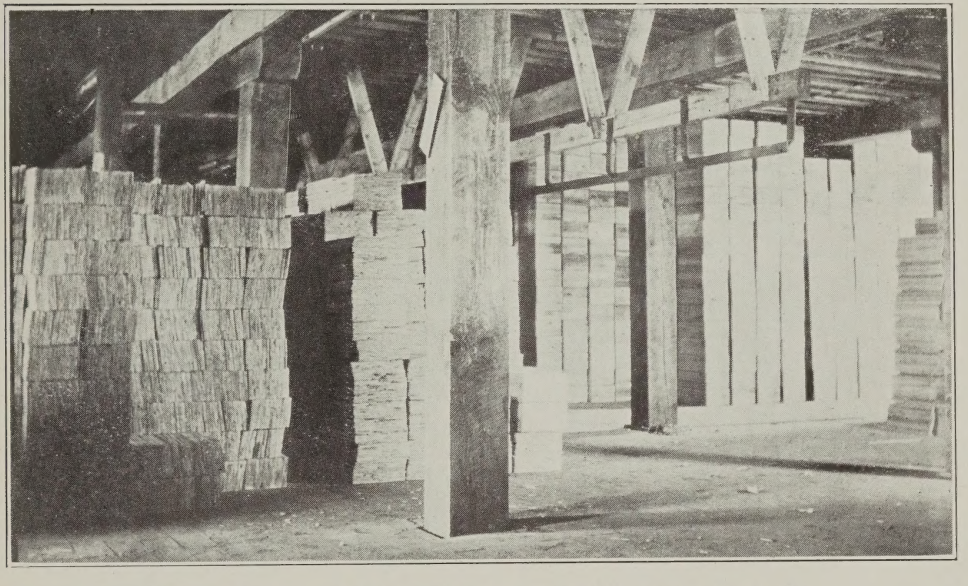
From the trials given it is believed that with asparagus at any rate, acidified brine is a success.

Canning and Jam Making for the Canadian Military Hospitals.

The season of 1917 has been one of great production in the preserving of fruit for the Canadian Military Hospitals. The total output was twice that of 1916 and five times that of 1915.

In order to make this increase some changes and additions were hurriedly made in the factory. Because of these improvements the work was done more systematically, with far less waste energy. The introduction of steam power enabled us to elevate to the top storey of the factory sugar and empty cans and cases. On the ground floor the fruits were received at a certain point and travelled continuously through the factory until finally they were deposited on the platform in the finished condition.

Some new features in the factory this year were: a washing and scalding machine working on the endless belt plan; a proper packing table fitted with a conveyor in the middle and a can chute above; a syruping device for running the syrup into the tins by gravity; a continuous conveying exhaust box for heating cans before sealing; power peeling machines; an electric generator for our own lighting; and a pulping machine for facilitating the handling of waste material.



Corner of warehouse showing piles of nailed cases and shooks.

The season started in early July with the making of strawberry jam. From then until January 10th, 1918, the factory was in constant operation.

Incoming supplies of sugar, boxes, cans, strapping, nails and sometimes fruit, such as Kieffer pears and apples, were unloaded into the warehouse which was directly on the railroad siding. By running our motor truck continuously between the warehouse and the factory empties and raw sugar were gradually brought to the factory and the finished article was gradually deposited at a convenient point for shipment.

As in 1915 and 1916 the 10 lb. hospital size tin was used for all classes of goods.

Owing to the increasing number of Military Convalescent Hospitals in Canada it has this year been found advisable to distribute in this country six carloads of fruits for the use of returned soldiers. The bulk of the shipments have, however, been made to the overseas hospitals.

Following is a list of the 1917 shipments. The total valuation of these goods, at market prices, amounts to $84,203.93 f.o.b. factory.

SHIPMENTS OF CANNED GOODS, 1917.

Strawberry Jam	645	cases No. 10 tins.
Raspberry Jam	546	(½ doz. per case.)
Black Currant Jam	387	
Blackberry Jam	631	
Gooseberry Jam	12	
Peach Jam	1,089	
Pear Jam	36	
Cherry Jelly	24	
Red Currants in syrup, 50%	21	
Cherry syrup, 50%	439	
Plum syrup, 40%	60	
Peaches in syrup, 50%	7,665	
Pears in syrup, 25%	3,792	
Apples in syrup, 20%	809	
Tomatoes	141	
	16,297	cases.
	(97,782 gallon cans)	

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